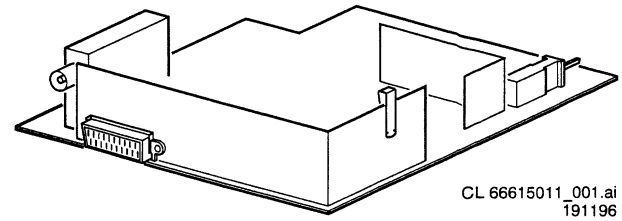
**Colour television** **Chassis**

Service
Service
**Service**

# L7.1A
**AA**



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# ServiceManual

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PHILIPS

# 1. Technical specifications

| | | | | |
|---|---|---|---|---|
| Mains voltage | : 150 - 276V AC; 50/60 Hz | | | |
| | : 90 - 276V 50/60 Hz (full range) | | | |
| Power cons. at 220V~ | : 14" 43W (stand-by ≤ 10W) | | | |
| | : 20" 52W (stand-by ≤ 10W) | | | |
| Aerial input impedance TV | : 75Ω - coax | | | |
| Max. aerial input VHF/UHF | : 100dBµV | | | |
| Pull-in range colour sync | : ± 300Hz | | | |
| Pull-in range horizontal sync | : ± 600Hz | | | |
| Pull-in range vertical sync | : 45 - 64.5 Hz | | | |
| Picture tube range | : 14" | : All tubes are universal tube | A34EDJ01X024 - LATAM | |
| | | | A34JXV70X | /67 |
| | | | A34JFQ40X(W) | /59 /50 /71 /97 /75 /73 /93 |
| | | | 370KSB22 - SYB - | /57 /58 |
| | : 20" | : Universal tubes | A48EEB05X020 - LATAM | |
| | | | A48KXR98X | /75 /73 /58B |
| | : 20" | : Northern tubes | A48JRK10X | /67 |
| | | | 510UFB22 TC69(DPY) | /59 /50 /97 /71 /57 /58 |
| | : 14" mono | : 16Ω 4W front firing loudspeaker | | |
| | : 20" mono | : 16Ω 3W front firing loudspeaker | | |

| | | |
|---|---|---|
| TV Systems | : /50 /67 | PAL B/G |
| | /75 | PAL B/H |
| | /73 /57 | PAL I |
| | /58 /59 | PAL B/GI & SECAM B/G D/K |
| | /77 /97 | NTSC M |
| | /93 | PAL D/I & SECAM D/K |

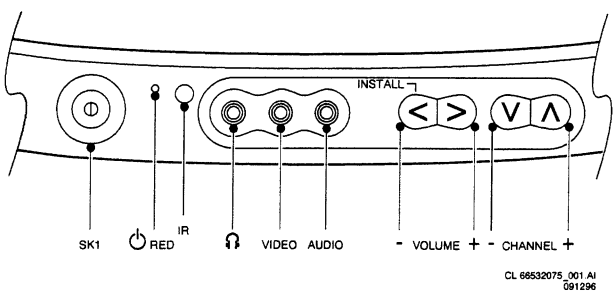
Indications : On Screen Display (OSD) green/red
: 1 LED (⏻ red high intensity, ⏻ red low intensity, "RC5" and error codes blinking red)

VCR programs : Any program numbers.

Tuning and operating system : VST / PLL

| | | | |
|---|---|---|---|
| UV1335 /IEC (VST) | : Band I | : 48.25 - 93.25 | MHz |
| | : Band III | : 168.25 - 216.25 | MHz |
| | : UHF | : 471.25 - 863.25 | MHz |
| UV1336 (PLL) | : Band I | : 55.25 - 83.25 | MHz |
| | : Band III | : 175.25 - 211.25 | MHz |
| | : UHF | : 471.25 - 801.25 | MHz |

Local operating functions : VOLUME + / - , PROGRAM + / -




# 2. Connection facilities

**Cinch:**

⊙ CINCH CVBS ⊖ (1V pp +/- 3dB 75 Ω max 2V DC)

⊙ CINCH AUDIO ⊖ (500mV RMS < 1K Ω max 2Volt RMS)

**Head phone:**

8 -600Ω/5mW

# 3. Safety instructions, Maintenance instructions, Warnings and Notes

## Safety instructions for repairs

**1.** Safety regulations require that during a repair:
- the set should be connected to the mains via an isolating transformer;
- safety components, indicated by the symbol ▲, should be replaced by components identical to the original ones;
- when replacing the CRT, safety goggles must be worn.

**2.** Safety regulations require that after a repair the set must be returned in its original condition. In particular attention should be paid to the following points:
- As a strict precaution, we advise you to resolder the solder joints through which the horizontal deflection current is flowing, in particular:
  - all pins of the line output transformer (LOT);
  - fly-back capacitor(s);
  - S-correction capacitor(s);
  - line output transistor;
  - pins of the connector with wires to the deflection coil;
  - other components through which the deflection current flows.

**Note:**

This resoldering is advised to prevent bad connections due to metal fatigue in solder joints and is therefore only necessary for television sets older than 2 years.
- The wire trees and EHT cable should be routed correctly and fixed with the mounted cable clamps.
- The insulation of the mains lead should be checked for external damage.
- The mains lead strain relief should be checked for its function in order to avoid touching the CRT, hot components or heat sinks.
- The electrical DC resistance between the mains plug and the secondary side should be checked (only for sets which have a mains isolated power supply). This check can be done as follows:
  - unplug the mains cord and connect a wire between the two pins of the mains plug;
  - set the mains switch to the on position (keep the mains cord unplugged!);
  - measure the resistance value between the pins of the mains plug and the metal shielding of the tuner or the aerial connection on the set. The reading should be between 4.5 MΩ and 12 MΩ;
  - switch off the TV and remove the wire between the two pins of the mains plug.
- The cabinet should be checked for defects to avoid touching of any inner parts by the customer.

## Maintenance instructions

It is recommended to have a maintenance inspection carried out by a qualified service employee. The interval depends on the usage conditions:
- When the set is used under normal circumstances, for example in a living room, the recommended interval is 3 to 5 years.
- When the set is used in circumstances with higher dust, grease or moisture levels, for example in a kitchen, the recommended interval is 1 year.

The maintenance inspection contains the following actions:
- Execute the above mentioned 'general repair instruction'.
- Clean the power supply and deflection circuitry on the chassis.
- Clean the picture tube panel and the neck of the picture tube.

## Warnings

**1.** In order to prevent damage to IC's and transistors any flash-over of the EHT should be avoided. To prevent damage to the picture tube the method, indicated in Fig. 3.1, has to be applied to discharge the picture tube. Make use of an EHT probe and a universal meter (position DC-V). Discharge until the reading of the meter is 0V (after approx. 30s).

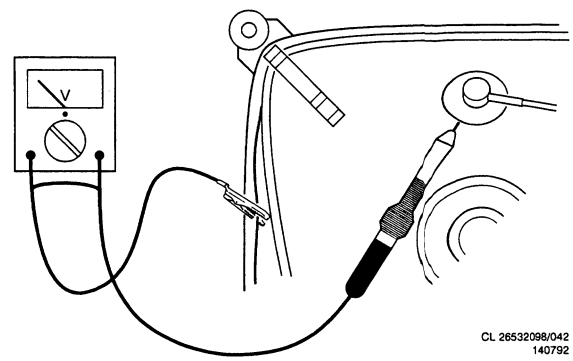



**Fig. 3.1**

**2. ESD**

All ICs and many other semiconductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce life drastically. When repairing, make sure that you are connected with the same potential as the mass of the set by a wristband with resistance. Keep components and tools also at this same potential.

**Available ESD protection equipment:**

| | |
|---|---|
| anti-static table mat large 1200x650x1.25mm | 4822 466 10953 |
| anti-static table mat small 600x650x1.25mm | 4822 466 10958 |
| anti-static wristband | 4822 395 10223 |
| connection box (3 press stud connections, 1 M ohm) | 4822 320 11307 |
| extension cable (2 m, 2 M ohm; to connect wristband to connection box) | 4822 320 11305 |
| connecting cable (3 m, 2 M ohm; to connect table mat to connection box) | 4822 320 11306 |
| earth cable (1 M ohm; to connect any product to mat or connection box) | 4822 320 11308 |
| complete kit ESD3 (combining all 6 prior products - small table mat) | 4822 310 10671 |
| wristband tester | 4822 344 13999 |

**3.** Together with the deflection unit and any multipole unit, the flat square picture tubes used form an integrated unit. The deflection and the multipole units are set optimally at the factory. Adjustment of this unit during repair is therefore not recommended.

4. Proceed with care when testing the EHT section and the picture tube.

5. Never replace any modules or any other parts while the set is switched on.

6. Use plastic instead of metal alignment tools. This will prevent any short circuits and the danger of a circuit becoming unstable.

7. Upon a repair of a transistor or an IC assembly (e.g. a transistor or IC with heatsink and spring) remounting should be carried out in the following order:
   1. Mount transistor or IC on heatsink with spring.
   2. Resolder the joints.

### Notes

1. Do not use heatsinks as earth reference.

2. The direct voltages and oscillograms should be measured with regard to the tuner earth (⊥), or hot earth (⊥↯) as this is called.

3. The direct voltages and waveforms are measured in the Service Default Mode (see chapter 8). Use a colour bar pattern of a pattern generator (e.g. PM5518).

4. The DC voltages and oscillograms are where necessary measured with (⊓) and without (⊁) aerial signal (settings as in Service Default Mode; see chapter 8). Voltages and oscillograms in the power supply section have been measured for both normal operation (⏻) and in the stand-by mode (⏻). As an input signal a colour bar pattern has been used.

5. The picture tube PWB has printed spark gaps. Each spark gap is connected between an electrode of the picture tube and the Aquadag coating.

# 4. Mechanical instructions

For the main carrier two service positions are possible (Fig. 4.1):

A: For faultfinding on the component side of the main carrier
B: For (de)soldering activities on the copper side of the main carrier

Position A can be reached by first removing the mains cord from it's fixation, then loosen the carrier lips (1) and then pulling the carrier panel (2) for approximately 10 cm.

Position B can be reached from position A after disconnecting the degaussing cable. Put the carrier on the line transformer side and if wanted use a screwdriver for an extra stable service position (see figure below).

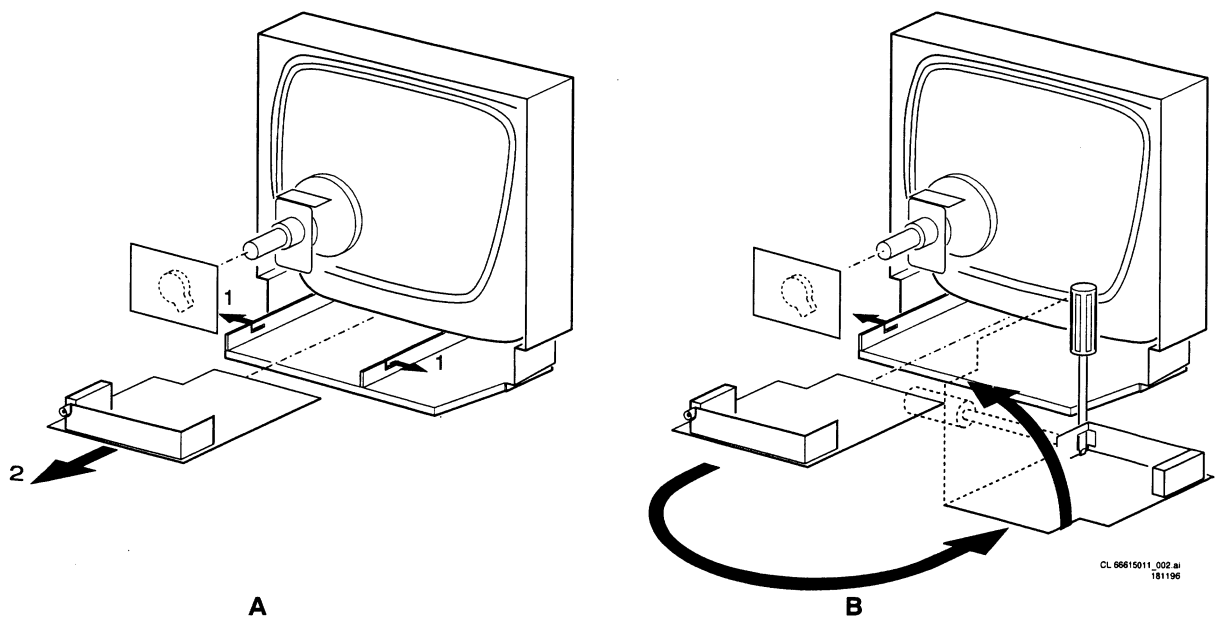
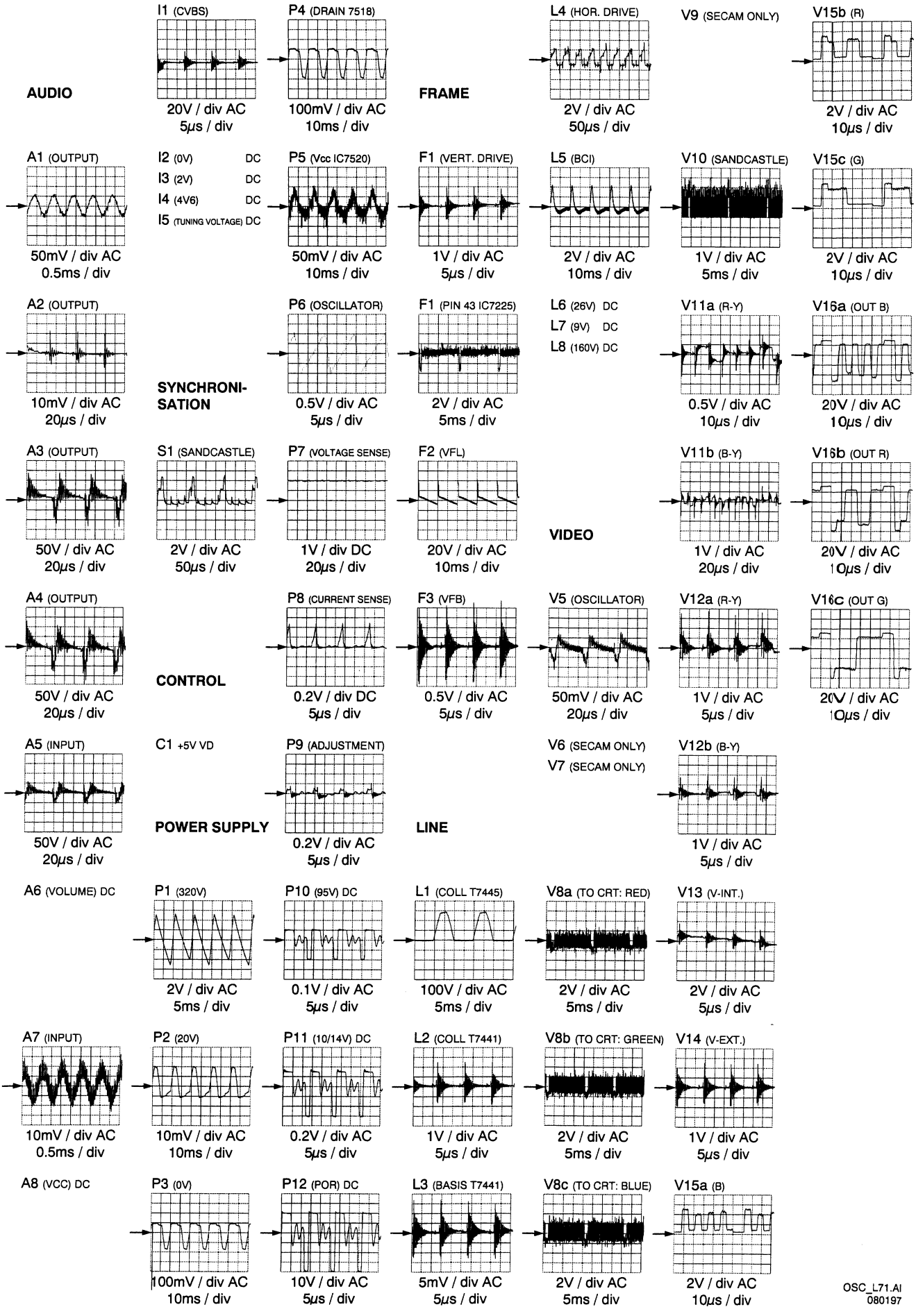



Fig. 4.1

# 5. Overview oscillograms / Übersicht Oszillogramme / Vue d'ensemble des oscillogrammes



# Survey of testpoints / Übersicht über die Teststellen / Presentation des points à tester

## MAIN CARRIER (Component side)

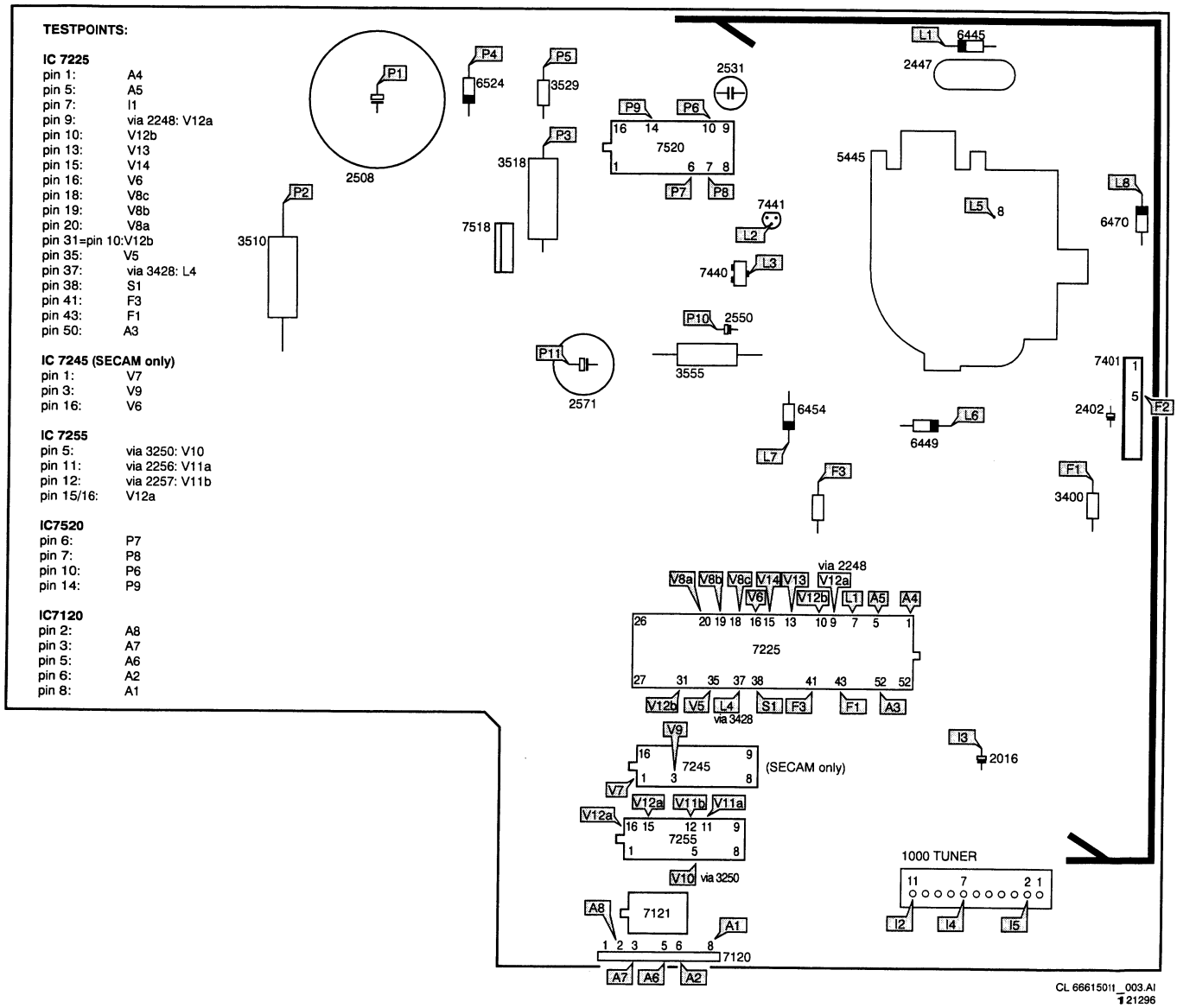



Fig. 5.1

## CRT PANEL

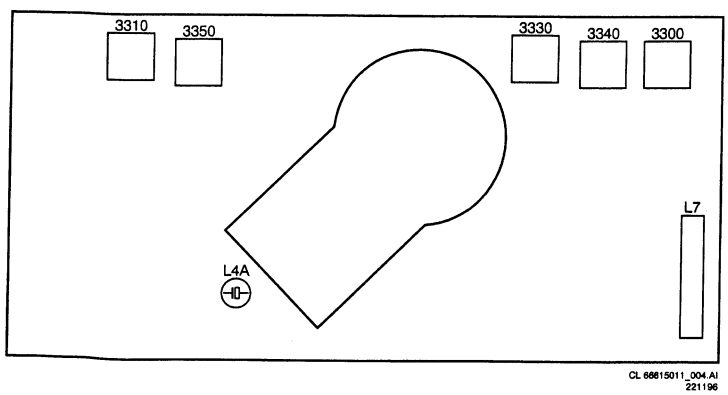
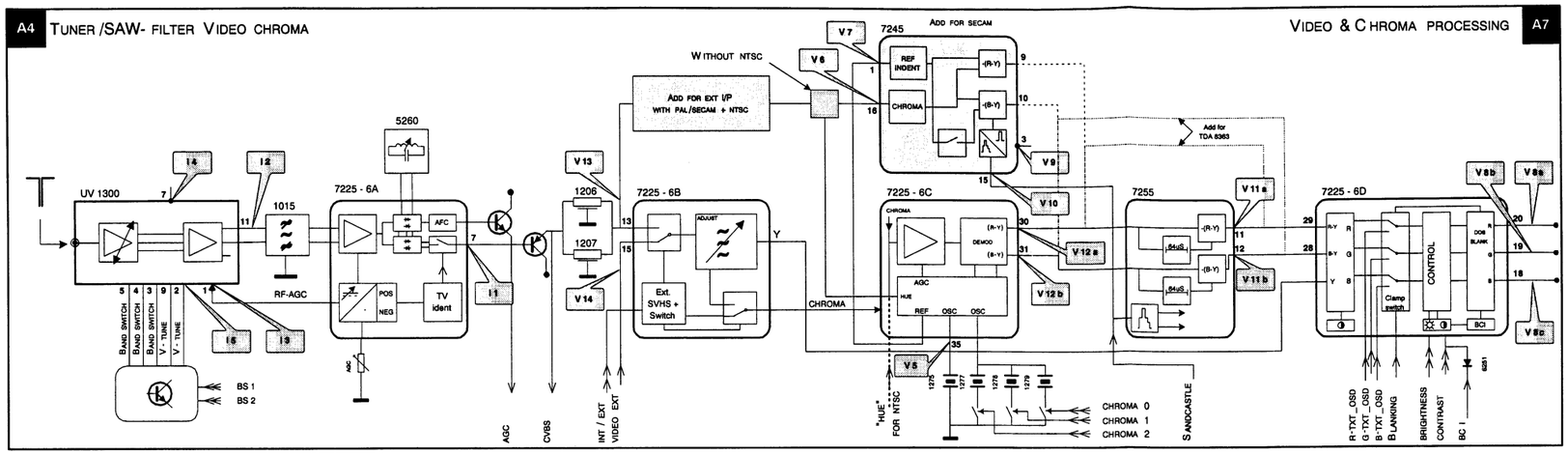
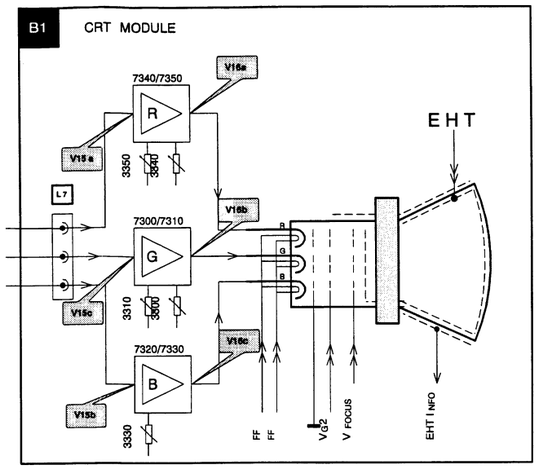


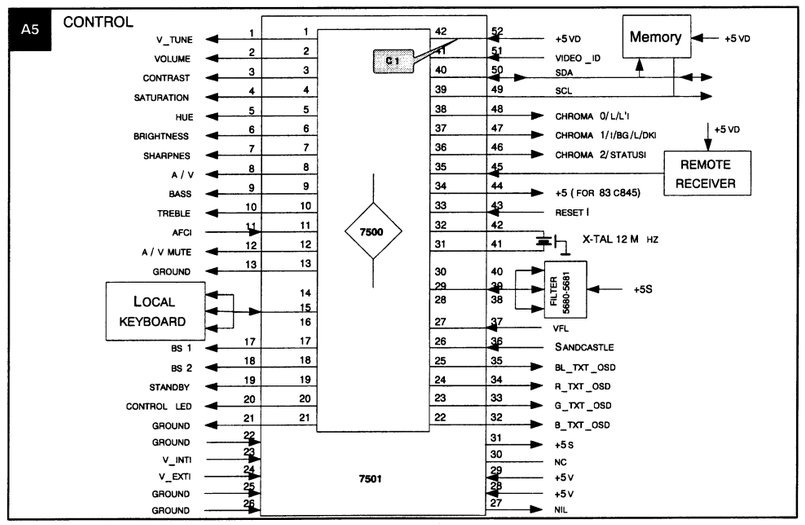

Fig. 5.2

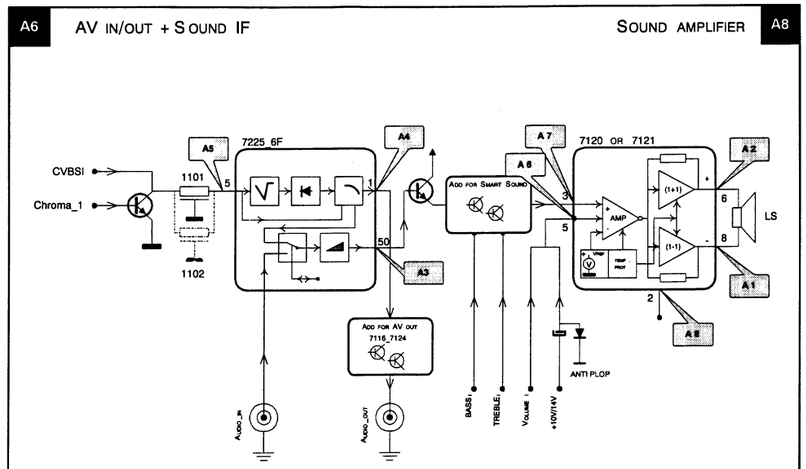
# Block diagram / Blockschaltbild / Diagramme synoptique

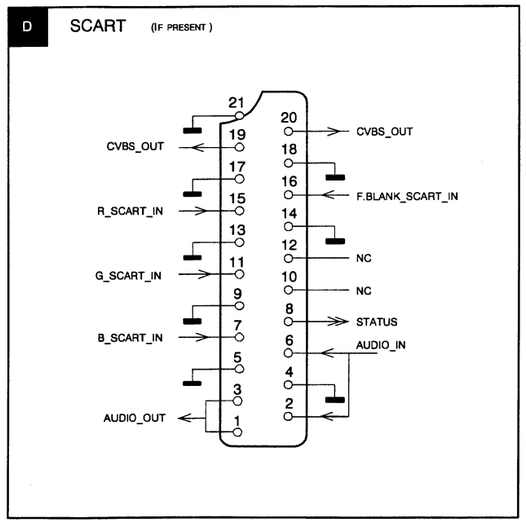
**Chassis L7.1A** **5**

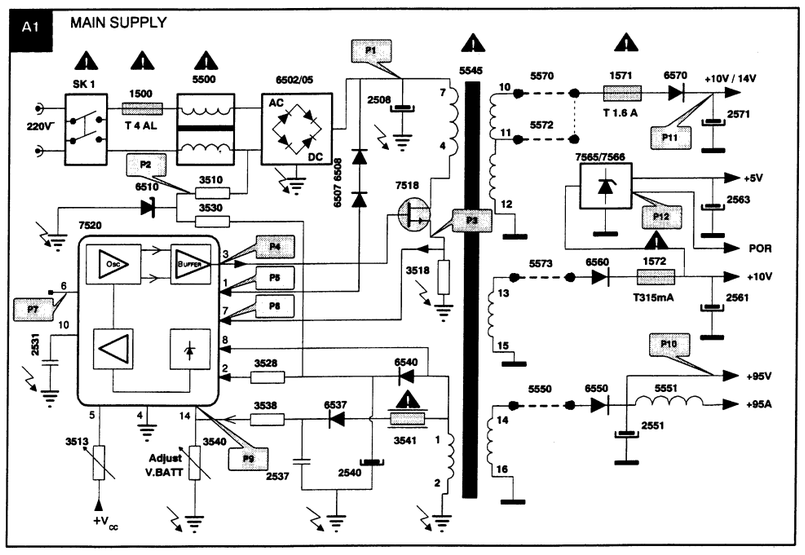


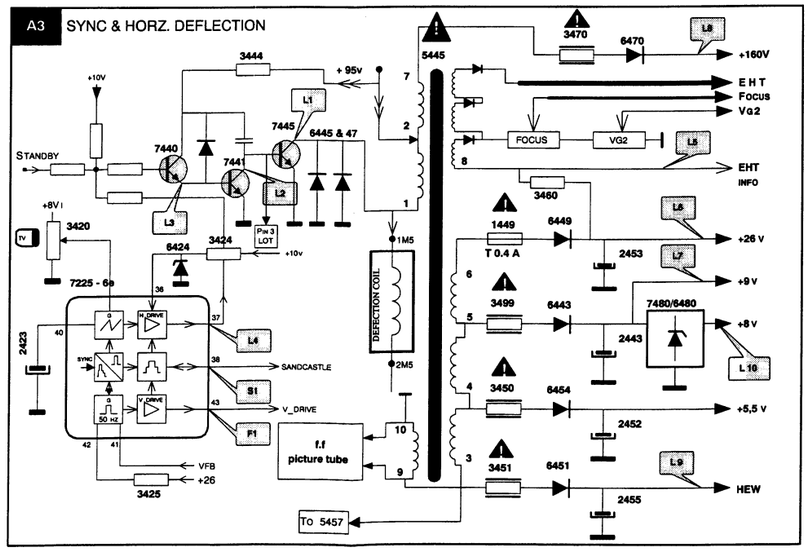



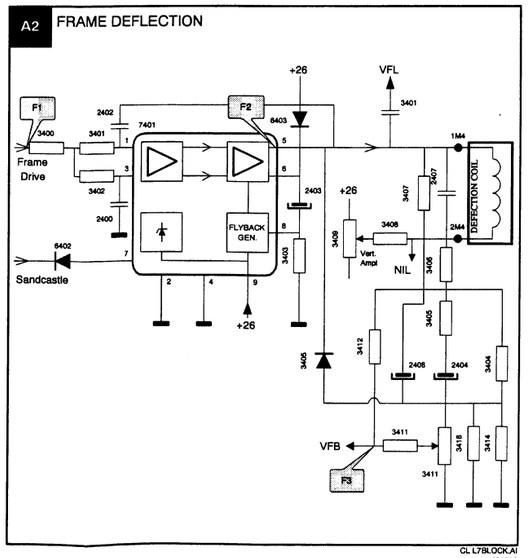

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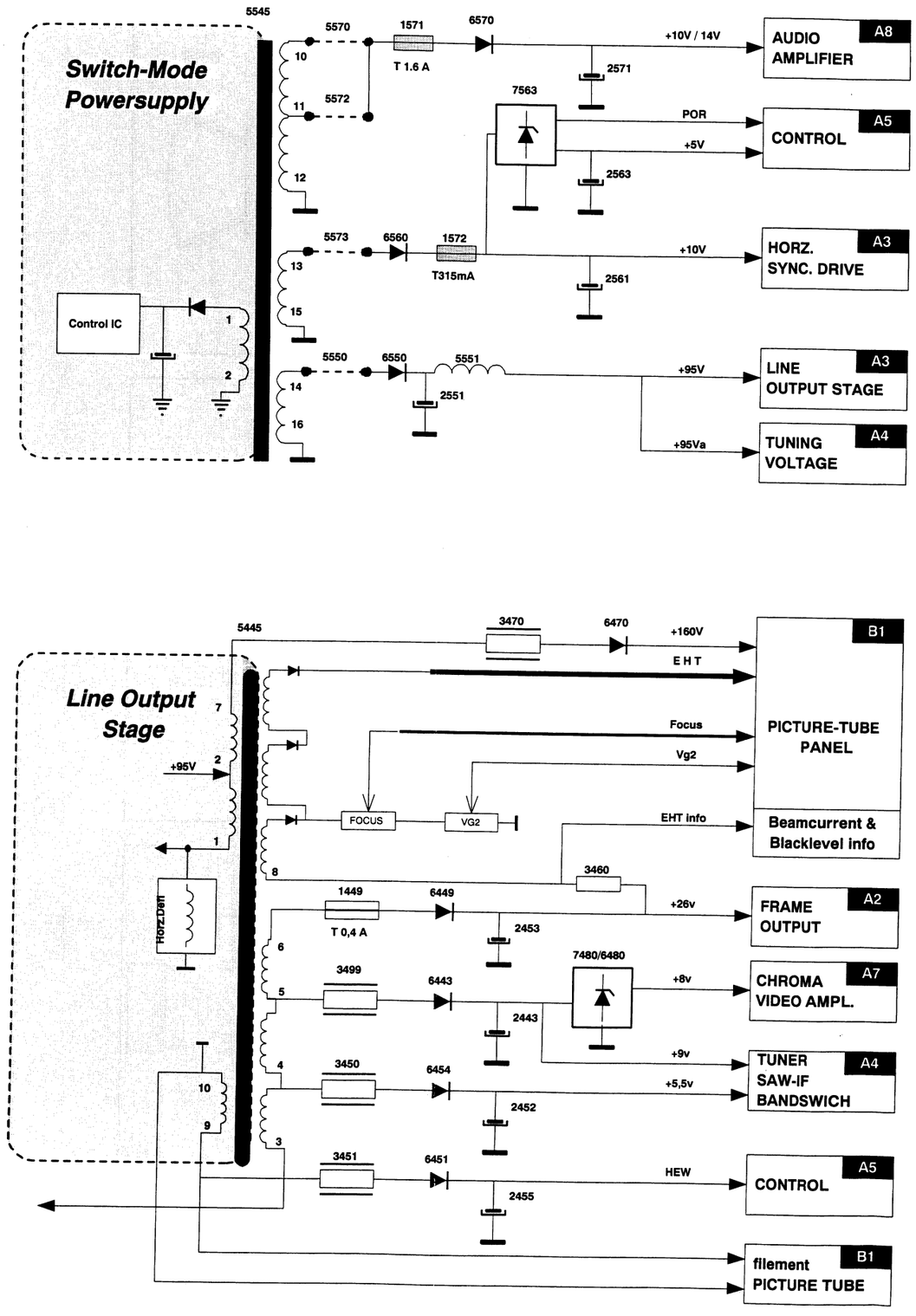
# Block diagram / Blockschaltbild / Diagramme synoptique



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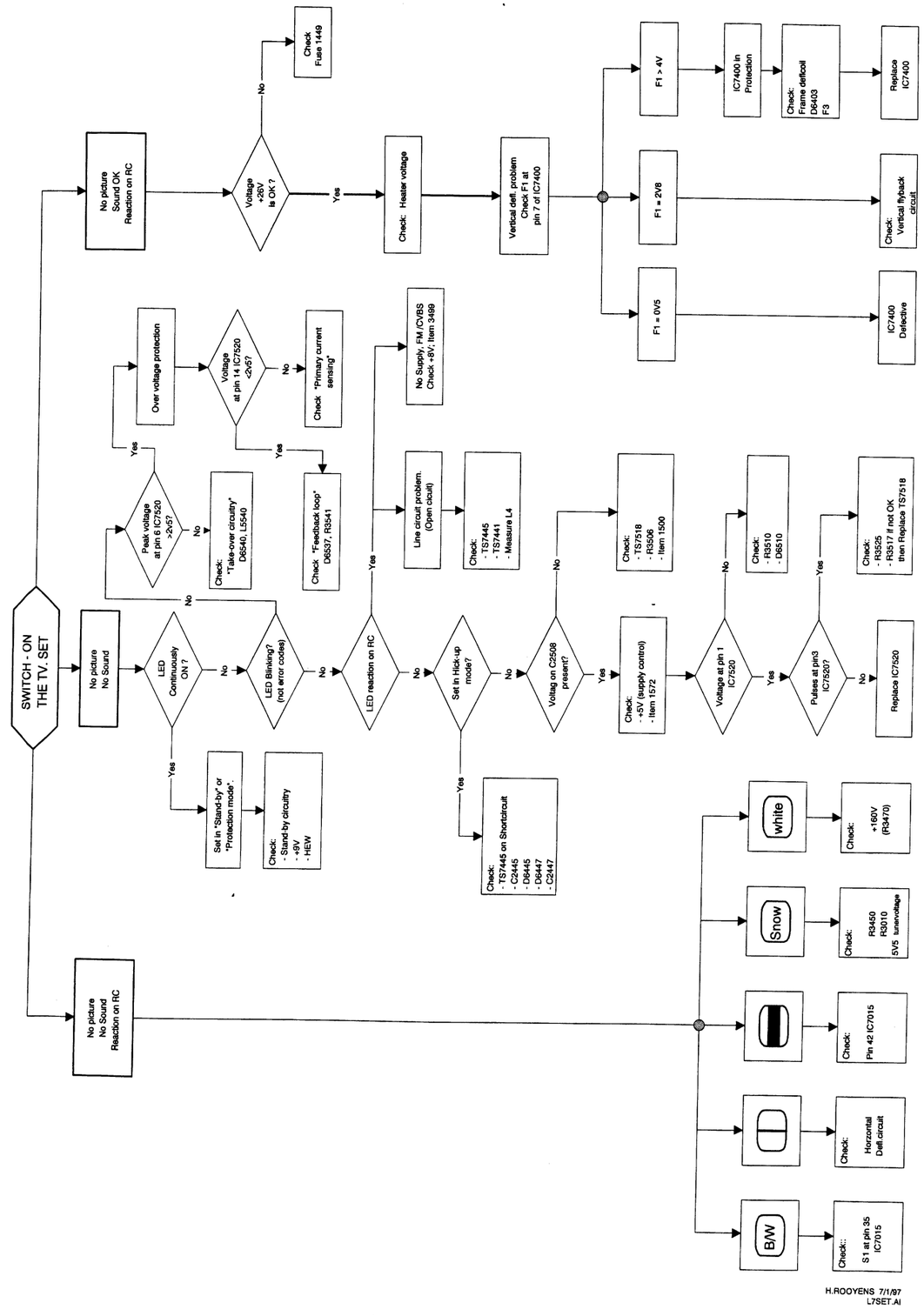
# 6. Fault finding tree & Repair facilities / Fehlersuchbaum & Reparaturhinweise / Aide au depannage & Conseils pour la réparations


SWITCH - ON THE TV. SET
No picture No Sound
Check Fuse 1449
No
Voltage +30V Is OK ?
Yes
Check: Heater voltage
Vertical deff. problem Check F1 at pin 7 of IC7400
F1 > 4V
IC7400 in Protection
Check: Frame deficoil D6403 F3
Replace IC7400
F1 = 2V8
Check: Vertical flyback circuit
F1 = 0V5
IC7400 Defective
Over voltage protection
Voltage at pin 14 IC7520 <2v5?
No
Check "Primary current sensing"
Yes
Peak voltage at pin 6 IC7520 >2v5?
No
Check: "Take-over circuitry" D6540, L5540
Check "Feedback loop" D6537, R3541
No Supply, FM /CVBS Check +5V, Item 3499
Line circuit problem. (Open circuit)
Check: - TS7445 - TS7441 - Measure L4
Check: - TS7518 - R3526 - Item 1500
Check: - R3510 - D6510
Check: - R3525 - R3517 if not OK then Replace TS7518
No picture No Sound Reaction on RC
LED Continuously ON ?
No
LED Blinking? (not error codes)
No
LED reaction on RC
No
Set in Hick-up mode?
No
Voltag on C2508 present?
Yes
Check: - +5V (supply control) - Item 1572
Voltage at pin 1 IC7520
Yes
Pulses at pin3 IC7520?
No
Replace IC7520
Yes
Set in "Stand-by" or "Protection mode":
Check: - Stand-by circuitry - +9V - HEW
Check: - TS7445 on Shortcircuit - C2445 - D6445 - D6447 - C2447
No picture No Sound Reaction on RC
white
Check: +160V (R3470)
Snow
Check: R3400 R3010 5V5 tunervoltage
Check: Pin 42 IC7015
Check: Horizontal Defl.circuit
B/W
Check:: S1 at pin 35 IC7015

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L7SET.AI

# Repair facilities

## 6.5 SDAM mode

This menu is being displayed whenever SDAM is entered. In this menu the error buffer can be inspected, and the option byte(s) can be (re)programmed. The overview of the menu is shown below:

| OPTION CODE | OPERATION HOURS | SOFTWARE VERSION | S |
|---|---|---|---|
| 02031 | 3427 | 2.2.1 | |
| ERROR | | 34300 | |
| OP | | VALUE | |

**Explanation:**

| | |
|---|---|
| 02031 | The hexadecimal representation of the option byte contents. |
| 3427 | The hexadecimal value of the life timer. |
| 2.2.1 | The software identification, version and cluster. |
| S | The character "S" to indicate that the TV set is in service mode. |
| OP | A two character short name for the option to be selected. |
| VALUE | The value of the selected option. |

The MENU UP/DOWN command can be used to select the next/previous option; the MENU LEFT/RIGHT command can be used to change the option value.

The possible options are listed in the following table:

Table: Options description for L7 versions

### Europe version

| Full option name | Option name abbreviation | Value range | Available for | |
|---|---|---|---|---|
| Virgin mode | VI | 0 = off, 1 = on | Asian Pacific, Latin America, USA | Bit 7 of byte 0 |
| Hotel mode | HO | 0 = not present, 1 = present | Asian Pacific PAL, Latin America | Bit 6 of byte 0 |
| Volume status | VS | 0 =stored for all, 1 =stored per channel | Asian Pacific PAL | Bit 5 of byte 0 |
| Child lock | CL | 0 = not present, 1 = present | Asian Pacific, Latin America, USA | Bit 4 of byte 0 |
| Hue | HU | 0 = not present, 1 = present | Asian Pacific PAL | Bit 3 of byte 0 |
| AV source | AV | 0 = not present, 1 = present | Asian Pacific, Latin America, USA | Bit 2 of byte 0 |
| UHF only | UH | 0 = not present, 1 = present | Asian Pacific PAL | Bit 1 of byte 0 |
| Smart sound | SS | 0 = not present, 1 = present | Asian Pacific PAL | Bit 0 of byte 0 |
| Smart picture | SP | 0 = not present, 1 = present | Asian Pacific PAL | Bit 7 of byte 1 |
| Auto scan | AS | 0 = not present, 1 = present | Asian Pacific, Latin America, USA | Bit 6 of byte 1 |
| 60/80 programmes | PR | 0 = 60 programmes,<br>1 = 80 programmes | Asian Pacific PAL | Bit 5 of byte 1 |
| Magnavox | MV | 0 = not Magnavox, 1 = Magnavox | Asian Pacific PAL | Bit 4 of byte 1 |
| National brand | NB | 0 = not National brand,<br>1 = National brand | Asian Pacific PAL | Bit 3 of byte 1 |
| Europe | EU | 0 = not Europe, 1 = Europe | Asian Pacific PAL | Bit 2 of byte 1 |
| System | SY | 0 = Single system (AP PAL, LatAm Tri-Norma),<br>1 = LA_BINORMA (LatAm Tri-Norma),<br>2 = LA_TRINORMA (LatAm Tri-Norma),<br>3 = AP-Multi,<br>4 = AP-Dual | Asian Pacific PAL, Latin America Tri-Norma | Byte 2 is 0000<br>Byte 2 is 0001<br>Byte 2 is 0010<br>Byte 2 is 0011<br>Byte 2 is 0100 |

# Repair facilities

## 6.1 Functional blocks

On both the service printing on the copper and the component side, functional blocks are indicated by lines and text.

## 6.2 Test points

The L7.1 chassis is equipped with test points in the service printing on both sides of mono-board. These test points are referring to the functional blocks as mentioned above:

* P1-P2-P3, etc.: Test points for the power supply
* L1-L2-L3, etc.: Test points for the line drive and line output circuitry
* F1-F2-F3, etc.: Test points for the frame drive and frame output circuitry
* S1-S2-S3, etc.: Test points for the synchronization circuitry
* V1-V2-V3, etc.: Test points for the video processing circuitry
* A1-A2-A3, etc.: Test points for the audio processing circuitry
* C1-C2-C3, etc.: Test points for the control circuitry
* T1-T2-T3, etc.: Test points for the teletext processing circuitry

The numbering is done in a for diagnostics logical sequence; always start diagnosing within a functional block, in the sequence of the relevant test points, for that functional block.

## 6.3 Service mode

The service mode can be split into two parts:
Service Default Mode (SDM) and Service Alignment Mode (SAM). For L7.1 these modes will be replaced by a combined mode, called SDAM.
The control system offers some features, which can be used by the service.
To entry the Service mode you have two possibilities:

- SDAM entry by Dealer Service Tool
- Short-circuit service pins M24 and M25 on PCB and switch power-on.

To leave the Service mode push the stand-by button; the error buffer will be cleared !!

Features are:

- Service settings after entry
- Service (sub)menu selection
- Error buffer display
- Software version & identification display
- Life timer (run timer) display

### 6.3.1 *The initial state after switching on in service mode is:*

System:

- For Multi-Europe sets PAL-BG
- For Multi-France sets SECAM-L
- For Bi-Norma and Tri-Norma sets PAL-M

Tuning:

- For sets with VST tuning:
  Programme number 1 is selected and the system will be tuned at the tuning data (for programme 1) read from EEPROM
- For sets with PLL tuning:
  Tune to a frequency of 475.25 MHz.

Further settings:

- The automatic switch off (no IDENT) timer and the sleep timer will be ignored.
- The child lock will be disabled.
- If the TV set was in hotel mode, this mode is disabled as long as the TV is in service mode.
- Brightness, saturation, sharpness, contrast and balance are initialised on 50% level.
- The volume is set to 25% level.
- After initialisation the TV set is normally controllable.
- To indicate that the TV is in service mode an "S" will be displayed (in green) in the top right corner of the screen. All other OSD will be in red.
- All displayed text strings in service mode are in English.
- The TV set will remain in SDAM after switching of by main switch; with stand-by you will leave this mode.

### 6.3.2 *Other features*

*RAM test*

At every start up of the TV, a read after write test for the complete RAM will be performed. If this check fails, the appropriate error number will be written in the error buffer. The patterns will be chosen in such a way that every bit of all bytes, will be written high and low.

*Life timer (run timer)*

During the life time cycle of the TV set a life timer is kept. This life timer only counts the normal operation hours, not the stand-by hours. Also at every switch on the life timer is incremented by one.

*Error buffer*

The last five errors, remembered from the EEPROM, are shown in the service main menu. This is called the error buffer. An error will be added to the buffer if this error differs from the last error in the buffer. The last found error is displayed on the left.

**Example:** Suppose the display shows:
3 4 1 3 1. This means the last found error is error number 3; the last found error but one is error number 4, and so on.
30000
43000
34300

## 6.4 Error codes

The following error numbers have been defined:
0 = No error
1 = Internal RAM error
2 = General I $^2$C error
3 = EEPROM Configuration error (Checksum error)
4 = I2C error (TDA9840 / TDA9852)
5 = I2C error (TDA8374/75) (NOT IN L7.1)
6 = EEPROM error
7 = I $^2$C error (PLL tuner)

# Repair facilities

### LATAM version

| Full option name | Option name abbreviation | Value range | Available for |
|---|---|---|---|
| Virgin mode | VI | 0 = off, 1 = on | Bit 7 of byte 0 |
| Child lock | CL | 0 = not present, 1 = present | Bit 6 of byte 0 |
| AV source | AV | 0 = not present, 1 = present | Bit 5 of byte 0 |
| Manual skip | SK | 0 = not present, 1 = present | Bit 4 of byte 0 |
| Vol limitter | VL | 0 = not present, 1 = present | Bit 3 of byte 0 |
| Auto scan | AS | 0 = not present, 1 = present | Bit 2 of byte 0 |
| System | SY | 0 = Single system (AP PAL, LatAm Tri-Norma),<br>1 = LA_BINORMA (LatAm Tri-Norma),<br>2 = LA_TRINORMA (LatAm) | Byte 2 =0000<br><br>Byte 2 = 0001<br>Byte 2 = 0010 |

### USA version

| Full option name | Option name abbreviation | Value range | Available for |
|---|---|---|---|
| Virgin mode | VI | 0 = off, 1 = on | Bit 7 of byte 0 |
| Child lock | CL | 0 = not present, 1 = present | Bit 6 of byte 0 |
| Wake timer | WU | 0 = not present, 1 = present | Bit 5 of byte 0 |
| AV (ext) | AV | 0 = not present, 1 = present | Bit 4 of byte 0 |
| Vol limitter | VL | 0 = not present, 1 = present | Bit 3 of byte 0 |
| Auto scan | AS | 0 = not present, 1 = present | Bit 2 of byte 0 |
| Auto Cable detect | AC | 0 = disable ,1 = enable | Bit 1 of byte 0 |

### LATAM close caption

| Full option name | Option name abbreviation | Value range | Available for |
|---|---|---|---|
| Virgin mode | VI | 0 = off, 1 = on | Bit 7 of byte 0 |
| Child lock | CL | 0 = not present, 1 = present | Bit 6 of byte 0 |
| AV source | AV | 0 = not present, 1 = present | Bit 5 of byte 0 |
| Manual skip | SK | 0 = not present, 1 = present | Bit 4 of byte 0 |
| Vol limitter | VL | 0 = not present, 1 = present | Bit 3 of byte 0 |
| Auto scan | AS | 0 = not present, 1 = present | Bit 2 of byte 0 |

# Repair facilities

**NTSC-AP**

| Full option name | Option name abbreviation | Value range | Available for |
|---|---|---|---|
| Virgin mode | VI | 0 = off, 1 = on | Bit 7 of byte 0 |
| Child lock | CL | 0 = not present, 1 = present | Bit 6 of byte 0 |
| AV source | AV | 0 = not present, 1 = present | Bit 5 of byte 0 |
| Auto scan | AS | 0 = disable ,1 = enable | Bit 4 of byte 0 |
| Auto Cable detect | AC | 0 = disable ,1 = enable | Bit 3 of byte 0 |

The format of the option-code is the following:

| 7 6 5 4 3 2 1 0 | 7 6 5 4 3 2 1 0 | 7 6 5 4 |
|---|---|---|
| x x x x x x x x | x x x x x x x x | x x x x |
| byte 0 | byte 1 | byte 2 |

All option-codes are presented hexadecimal in the service mode and not used bits are always 0.

**Example:** Option code C 0 1 0 4 in an Europe set means:
binary 1100 0000 0001 0000 0100

This is a set with the following configuration:
- Virgin mode on
- Hotel mode present
- Magnavox set
- System PAL-I / PAL DK

If the EEPROM is replaced by a new one the set has to be installed according the option code.

## 6.6 Dealer remote used as a Dealer Service Tool (DST)

The purpose of the dealer remote is to enter the Service Alignment Mode or the Service Default Mode of the L7 chassis, simply by pressing respectively the ALIGN or the DEFAULT key of the DST.

DEFAULT key of the DST.

The main features are:
- Entering the dealer mode and executing commands in this mode must be done by RC5 remote control.
- Entry of the dealer mode is possible in all states, except from stand-by.
- Read the error buffer even if the OSD is not working at all. This is done via the blinking LED procedure (see 6.6).
- All software is suspended till the dealer remote mode is left.

The dealer mode is left if:
- The stand-by command is received

## 6.7 Blinking LED procedure

Via the DIAGNOSE 1 (for error 1) through the DIAGNOSE 5 (for error 5) commands of the DST, the error buffer can be made visible via the blinking LED. This is useful if the screen is not working properly.
The method is to use the LED pulses with as many pulses as the error number, followed by a time period of 3 seconds in which the LED is off.
E.g. error code 4 will result in four times the sequence LED on for 0.25 seconds / LED off for 0.25 seconds. After this sequence the LED will be off for 3 seconds.

## 6.8 Downloading of tuning data with the DST

Downloading of tuning data (programme number, frequency and system) via the DST will be made possible.
This downloading is only possible in the version containing PLL tuning for Europe.

## 6.9 Hotel-mode and the hospital mode

The L7 chassis has one special mode, called the hotel mode.

Hotel mode:
- Installation menu cannot be entered.
- When entering the hotel mode the maximum volume will be the current value.
- The set will always switch to a selectable channel when the set is switched on.

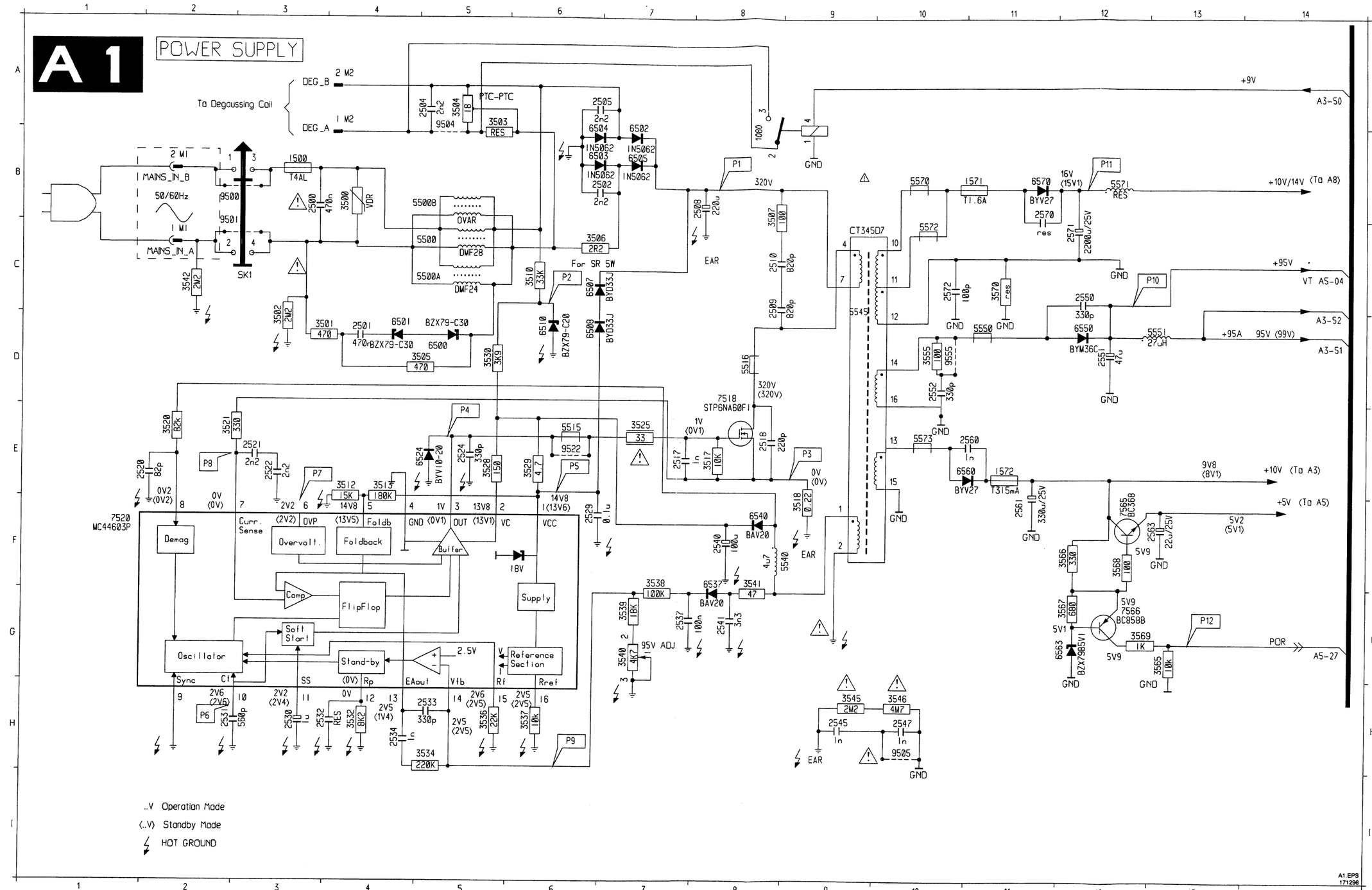
Entering the hotel-mode:
- Select channel 38
- Push the menu button on the local keyboard and the OSD-button of the RC simultaneously for 3 seconds.

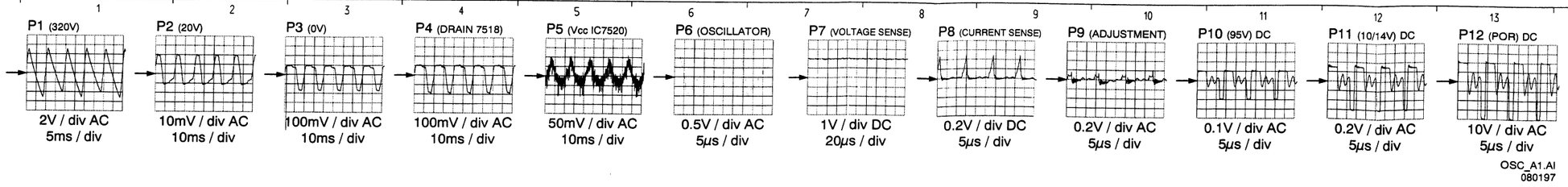
Leaving the hotel mode:
- Same as entering the hotel mode.

OSD will tell if hotel mode is on or off.

# Power supply / Netzteil / Alimentation

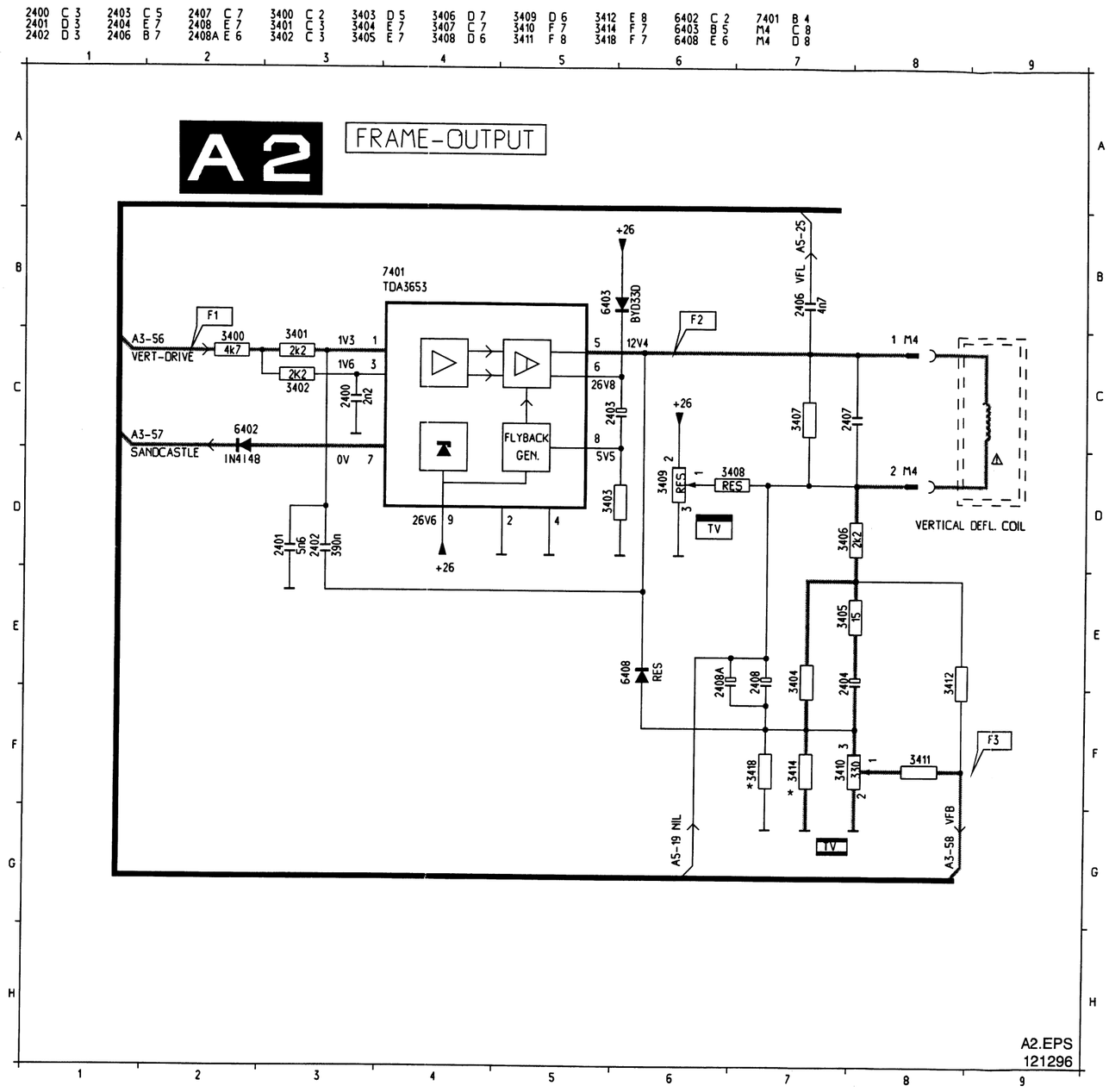
**Chassis L7.1A** **11**



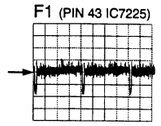



# Frame output / Raster Ausgang / Sortie trame



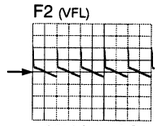



F1 (PIN 43 IC7225)



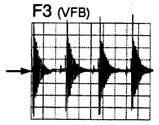
2V / div AC
5ms / div

F2 (VFL)



20V / div AC
10ms / div

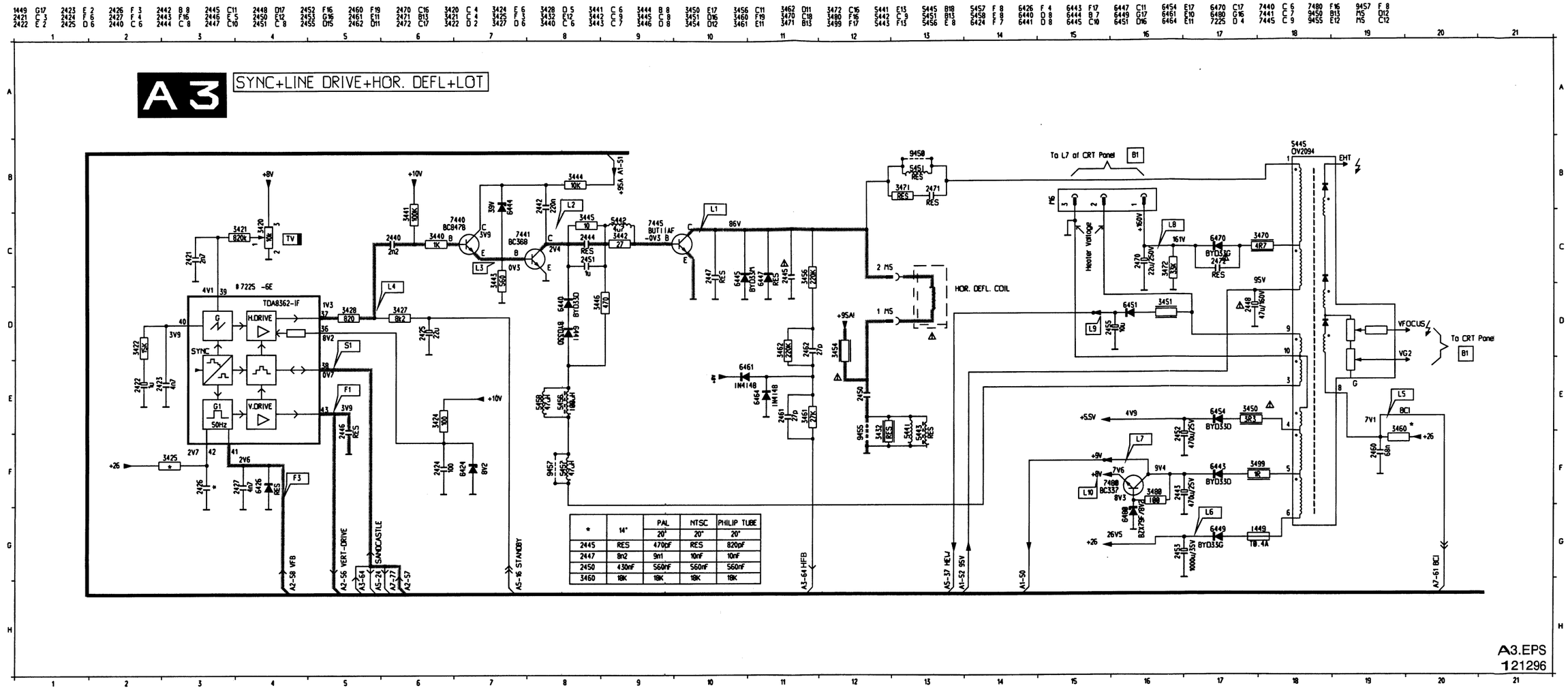
F3 (VFB)



0.5V / div AC
5µs / div

OSC_A2.AI
101296

# A3 SYNC+LINE DRIVE+HOR. DEFL+LOT




| * | 14" | PAL | NTSC | PHILIP TUBE |
|---|---|---|---|---|
| | | 20" | 20" | 20" |
| 2445 | RES | 470pF | RES | 820pF |
| 2447 | 8n2 | 9n1 | 10nF | 10nF |
| 2450 | 430nF | 560nF | 560nF | 560nF |
| 3460 | 18K | 18K | 18K | 18K |

F1 (PIN 43 IC7225)
2V / div AC
5ms / div

F3 (VFB)
0.5V / div AC
5µs / div

L1 (COLL T7445)
100V / div AC
5ms / div

L2 (COLL T7441)
1V / div AC
5µs / div

L3 (BASIS T7441)
5mV / div AC
5µs / div

L4 (HOR. DRIVE)
2V / div AC
50µs / div

L5 (BCI)
2V / div AC
10ms / div

L6 (26V) DC
L7 (9V) DC
L8 (160V) DC

S1 (SANDCASTLE)
2V / div AC
50µs / div

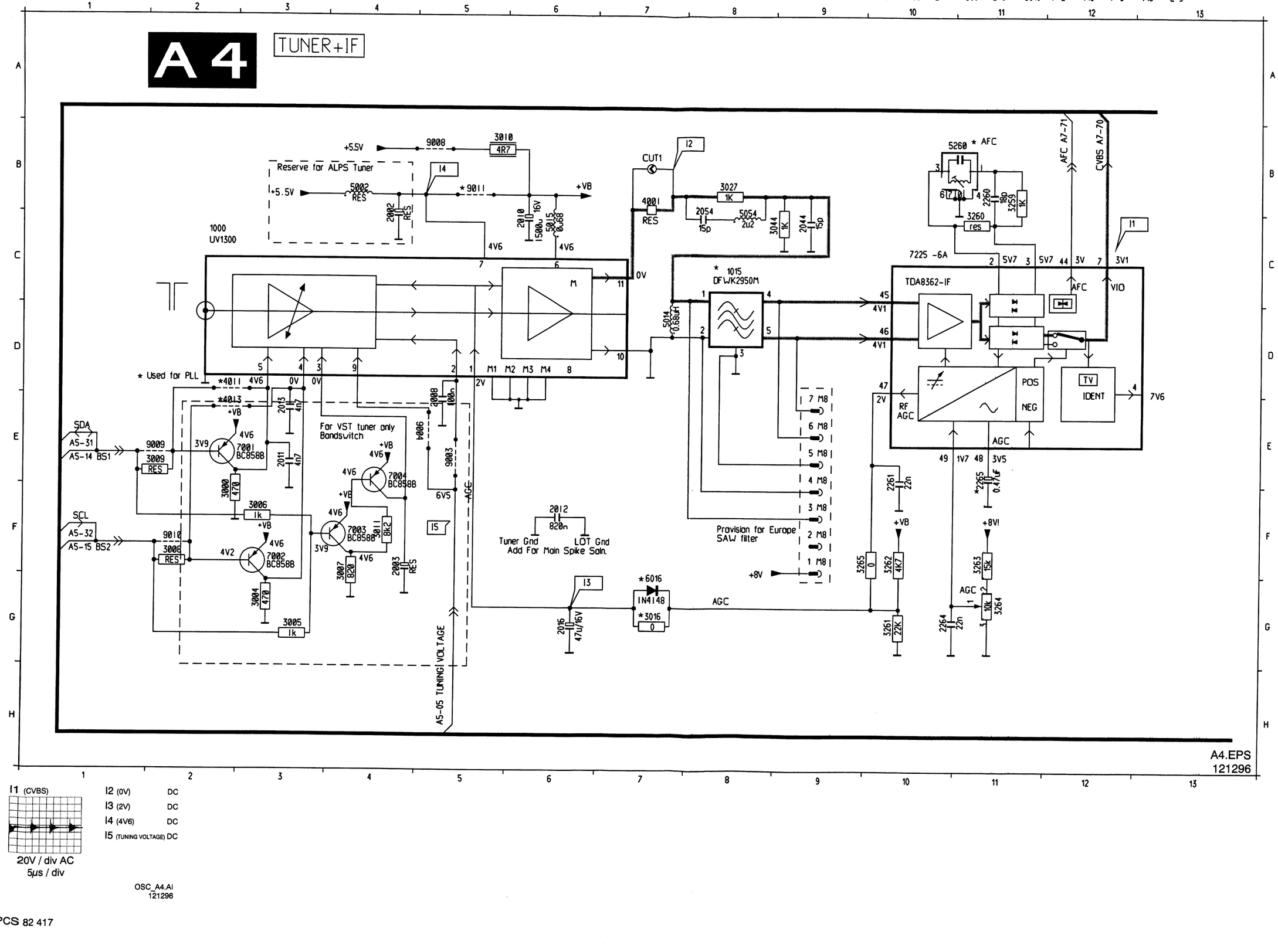
OSC_A3.AI
080197

A3.EPS
121296

# Tuner + IF / Tuner + ZF / FI + syntoniseur



1000 C 2 1015 C 8 2002 C 4 2003 F 4 2008 E 5 2010 C 6 2011 E 3 2012 F 6 2013 E 3 2016 G 6 2044 C 9 2054 C 8 2260 B11 2261 E10 2264 G10 2265 E11 3000 F 2 3004 G 3 3005 G 3 3006 F 3 3007 F 4 3008 F 2 3009 E 2 3010 B 5 3011 F 4 3016 G 7 3027 B 8 3044 C 8 3259 B11 3260 C11 3261 G10 3262 F10 3263 F11 3264 G11 3265 F 9 4001 B 7 4011 D 2 4013 E 2 5002 B 4 5014 D 7 5015 C 6 5054 C 8 5260 B10 6016 F 7 7001 E 2 7002 F 3 7003 F 4 7004 E 4 7225 C10 9003 E 5 9004 E 5 9008 B 5 9009 E 2 9010 F 2 9011 B 5 M8 F 9 M8 F 9 M8 F 9 M8 E 9 M8 E 9



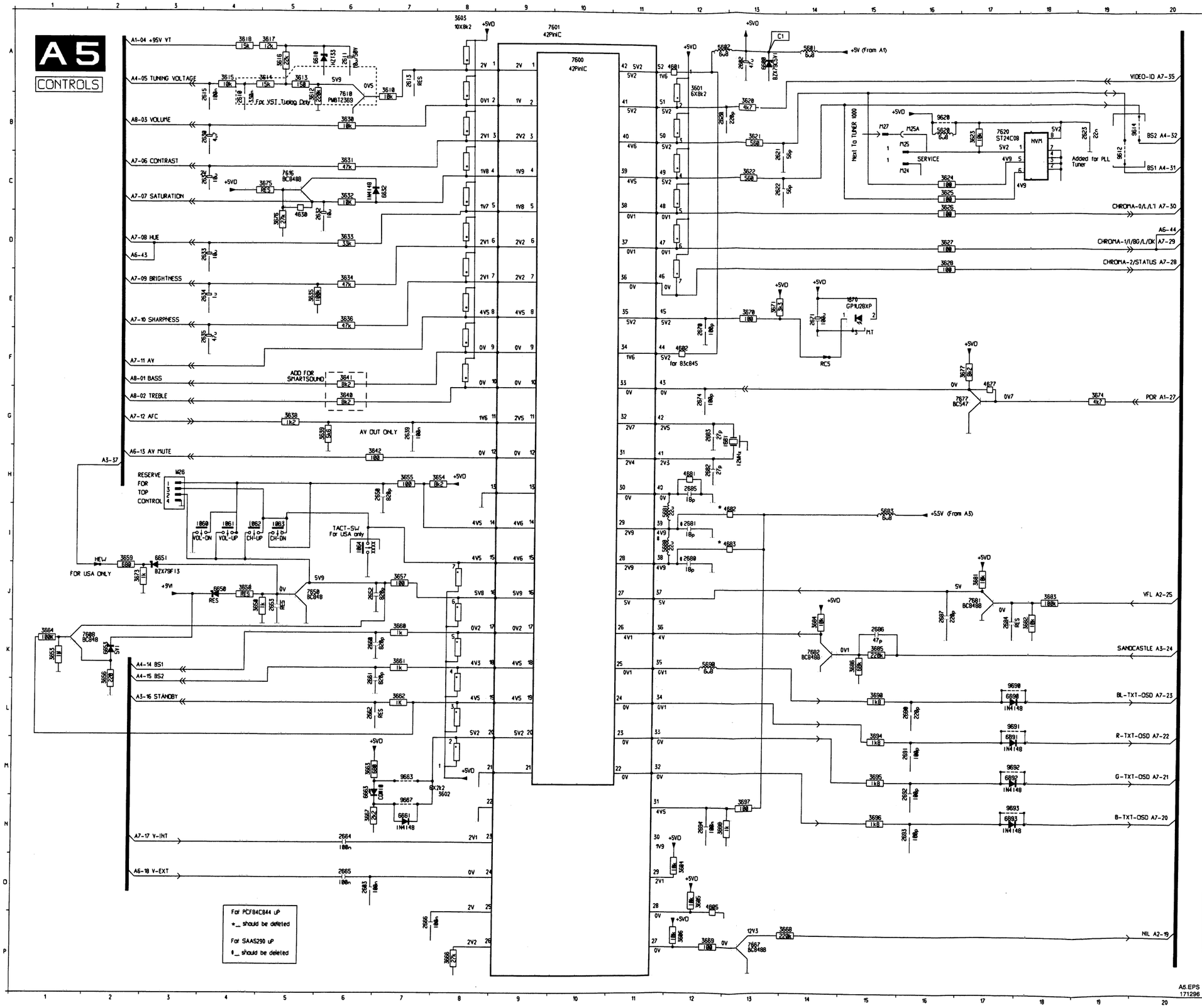

I1 (CVBS)



20V / div AC
5µs / div

| | | |
|---|---|---|
| I2 (0V) | DC |
| I3 (2V) | DC |
| I4 (4V6) | DC |
| I5 (TUNING VOLTAGE) | DC |

OSC_A4.AI
121296

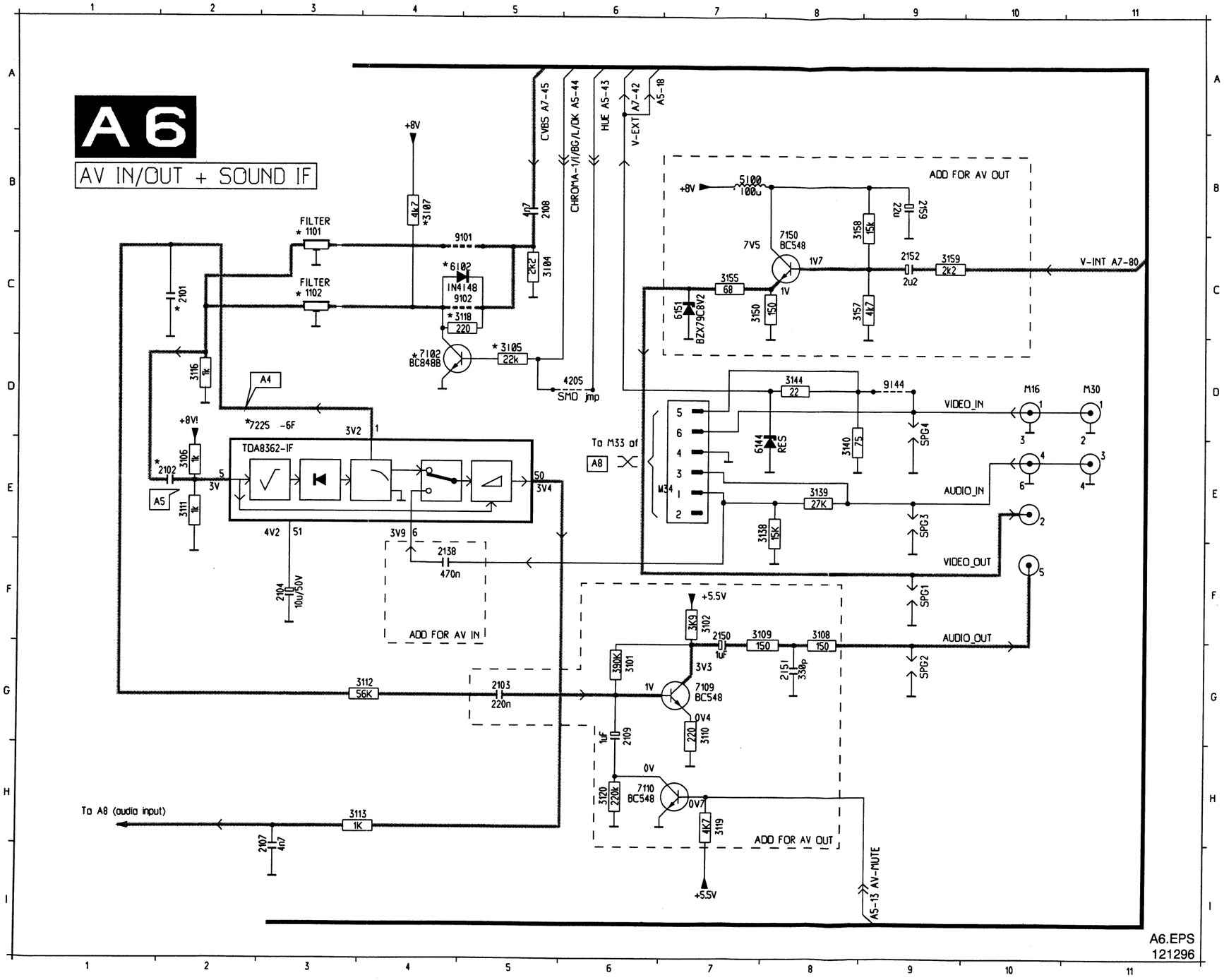



C1 +5V VD

PCS 82 418

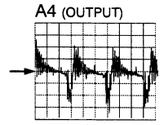
# AV in/out + sound IF / AV Ein/Aus + Ton ZF / AV entrée/sortie + FI son

Chassis L7.1A 16



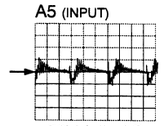

| | | |
|---|---|---|
| 1101 | C | 3 |
| 1102 | C | 3 |
| 2101 | C | 2 |
| 2102 | E | 2 |
| 2103 | G | 5 |
| 2104 | F | 3 |
| 2107 | I | 5 |
| 2108 | B | 5 |
| 2109 | G | 6 |
| 2138 | F | 4 |
| 2150 | F | 7 |
| 2151 | G | 8 |
| 2152 | C | 9 |
| 2159 | B | 9 |
| 3101 | G | 6 |
| 3102 | F | 7 |
| 3104 | C | 5 |
| 3105 | D | 5 |
| 3106 | E | 2 |
| 3107 | B | 4 |
| 3108 | F | 8 |
| 3109 | F | 7 |
| 3110 | G | 7 |
| 3111 | E | 2 |
| 3112 | G | 4 |
| 3113 | H | 4 |
| 3116 | D | 2 |
| 3118 | C | 5 |
| 3119 | H | 7 |
| 3120 | H | 6 |
| 3138 | E | 8 |
| 3139 | E | 8 |
| 3140 | E | 8 |
| 3144 | D | 8 |
| 3150 | C | 7 |
| 3155 | C | 7 |
| 3157 | C | 8 |
| 3158 | B | 8 |
| 3159 | C | 9 |
| 4205 | D | 6 |
| 5100 | B | 7 |
| 6102 | C | 4 |
| 6144 | E | 7 |
| 6151 | C | 7 |
| 7102 | D | 4 |
| 7109 | G | 7 |
| 7110 | H | 6 |
| 7150 | C | 8 |
| 7225 | D | 2 |
| 9101 | C | 5 |
| 9102 | C | 5 |
| 9144 | D | 9 |
| M16 | D | 10 |
| M30 | D | 11 |
| M34 | E | 7 |
| SPG1 | F | 9 |
| SPG2 | G | 9 |
| SPG3 | E | 9 |
| SPG4 | D | 9 |

A4 (OUTPUT)



50V / div AC
20µs / div

A5 (INPUT)



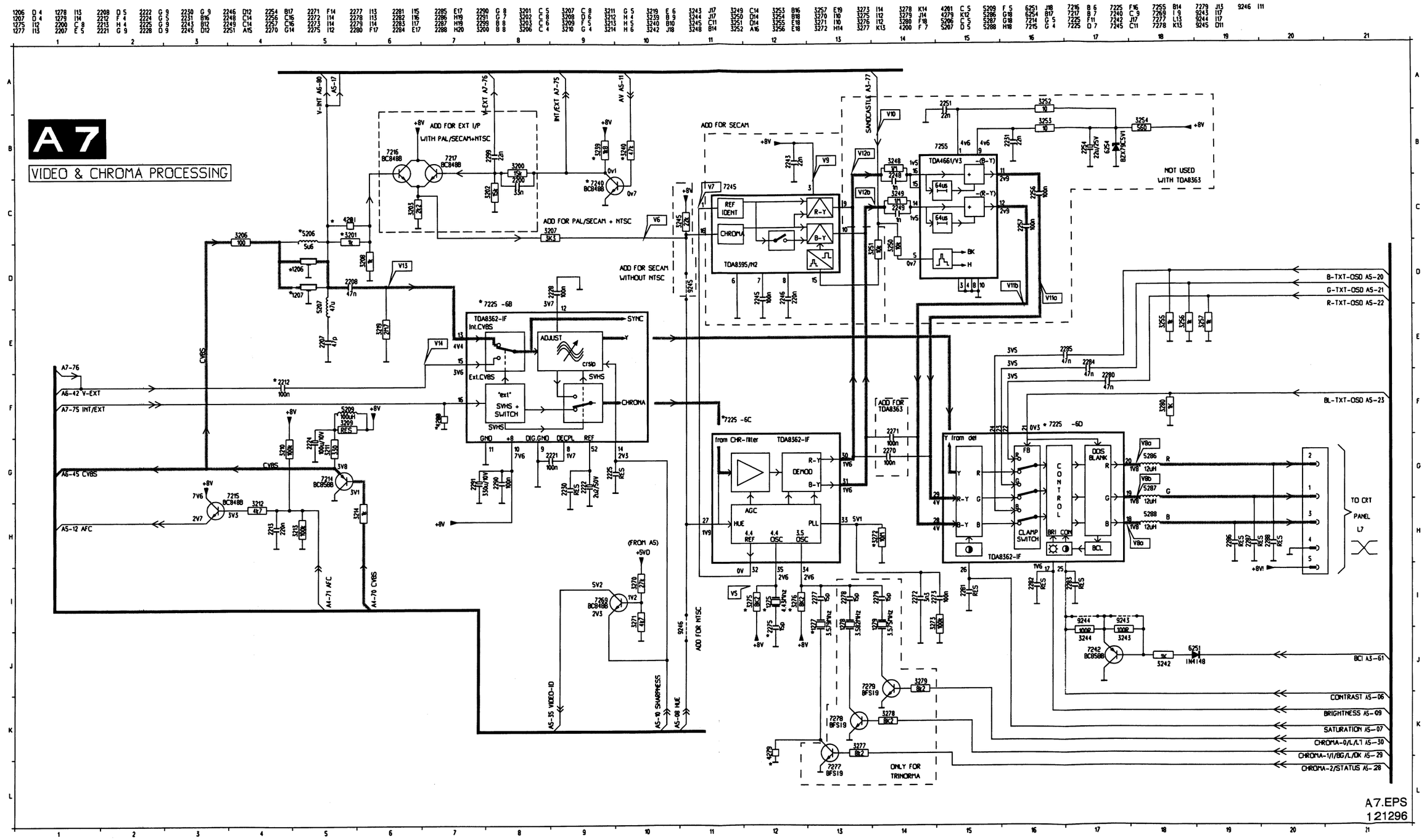
50V / div AC
20µs / div

A8 (VCC) DC

OSC_A6.AI
121296

# A7

VIDEO & CHROMA PROCESSING




V5 (OSCILLATOR)
50mV / div AC
20µs / div

V6 (SECAM ONLY)
V7 (SECAM ONLY)

V8a (TO CRT: RED)
2V / div AC
5ms / div

V8b (TO CRT: GREEN)
2V / div AC
5ms / div

V8c (TO CRT: BLUE)
2V / div AC
5ms / div

V9 (SECAM ONLY)

V10 (SANDCASTLE)
1V / div AC
5ms / div

V11a (R-Y)
0.5V / div AC
10µs / div

V11b (B-Y)
1V / div AC
20µs / div

V12a (R-Y)
1V / div AC
5µs / div

V12b (B-Y)
1V / div AC
5µs / div

V13 (V-INT.)
2V / div AC
5µs / div

V14 (V-EXT.)
1V / div AC
5µs / div

OSC_A7.AI
070897

# A8 SOUND AMPLIFIER

From A6 (audio input)

+10V/14V

7183 BC848B

3188 1k

2105 10u/50V

9104 Only v/o SMARTSOUND

2106 27n

3170 470

3121 6k8

2120 220n

A7

2110 100n

2111 220uF

+10V/14V

A8

7120 TDA7056B/N2

Vp

1 n.c.

9 n.c.

3 pos input

5 DC vol control

6 +

8 -

1 + 1

1 - 1

Vref

TEMP PROT

signal ground

power ground

4 GND

7 GND

3W SOUND

For AP only

2116 33n

2117 12n

2122 1n

3129 3k3

3122 1k8

3123 1k8

3124 470k

2124 270n

7124 BC848

H: BB Off

L: BB On

A5-01 BASS

H: Treble Off

L: Treble On

A5-02 TREBLE

7116 BC848

3117 470R

ADD FOR SMART SOUND

A6

A5-03 VOLUME

3145 3K3

6111 IN4148

3125 22K

2121 220n

+10V/14V

2130 220u/25V

3142 270R

6142 IN4148

6110 IN4148

A2

2125 RES

2129 RES

GND

3127 RES

Add when No Headphone

9127

0020

8

7

1 M19

3 M19

SP69

2136 10

3136 100

56R

2126 RES

GND

2127 RES

3135 56R

GND

2135 10

100

1

SP612

9125

A1

M11

M33

SP67

SP610

VIDEO_F

AUDIO_F

SP68

SP611

2190 330p

3153 27k

To M34 of A6

ADD FOR FRONT CINCH AV IN

+10V/14V

7121 TDA7052B

Vp

7 n.c.

2 pos input

4 DC vol control

5 +

8 -

1 + 1

1 - 1

Vref

TEMP PROT

signal ground

power ground

3 1W

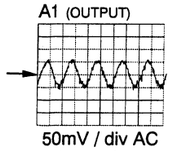
6 GND

For Europe and USA

A8.EPS
121296

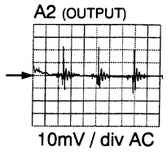
0020 C11
2105 B 3
2106 B 3
2110 B 6
2111 B 7
2116 C 5
2117 C 5
2120 C 5
2121 C 5
2122 C 6
2124 D 4
2125 D 9
2126 D11
2127 D11
2129 D 9
2130 E 3
2135 D10
2136 D10
2190 G12
3117 D 5
3121 C 3
3122 C 4
3123 C 4
3124 D 3
3125 E 4
3127 E 9
3129 C 3
3135 D11
3136 D10
3142 E 3
3145 E 4
3153 G12
3170 B 4
3188 B 2
6110 F 4
6111 E 4
6142 E 3
7116 C 4
7120 C 6
7121 C 6
7124 C 3
7183 A 4
9104 B 4
9125 E11
9127 C11
M11 E13
M19 C13
M19 D13
SPG10 F13
SPG11 H13
SPG12 D13
SPG7 F12
SPG8 G13
SPG9 D12

A1 (OUTPUT)



50mV / div AC
0.5ms / div

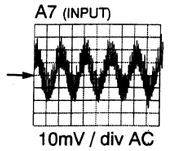
A2 (OUTPUT)



10mV / div AC
20µs / div

A6 (VOLUME) DC

A7 (INPUT)

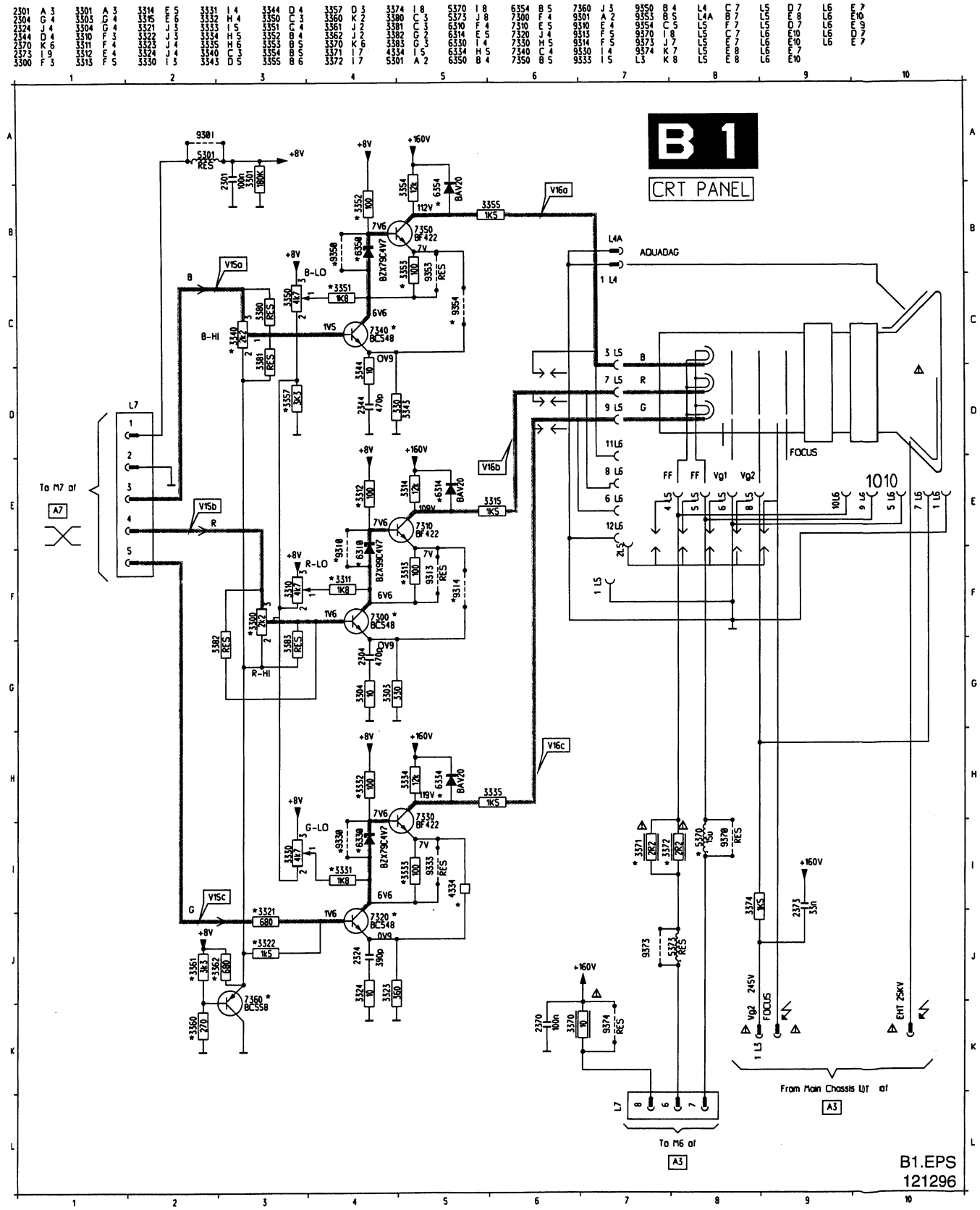


10mV / div AC
0.5ms / div

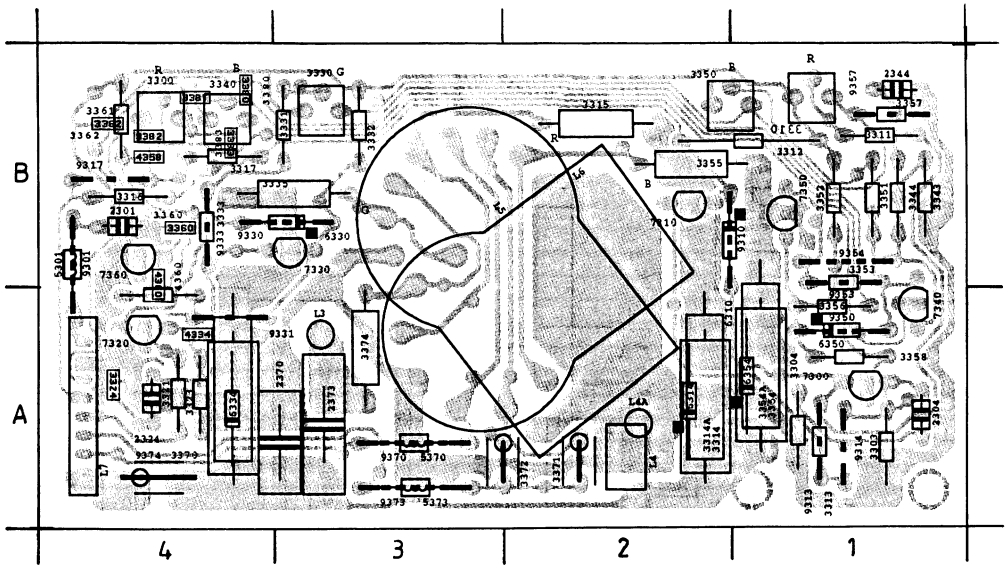
A8 (VCC) DC

OSC_A8.AI
101296

# CRT panel / CRT-Platine / Platine tube cathodique



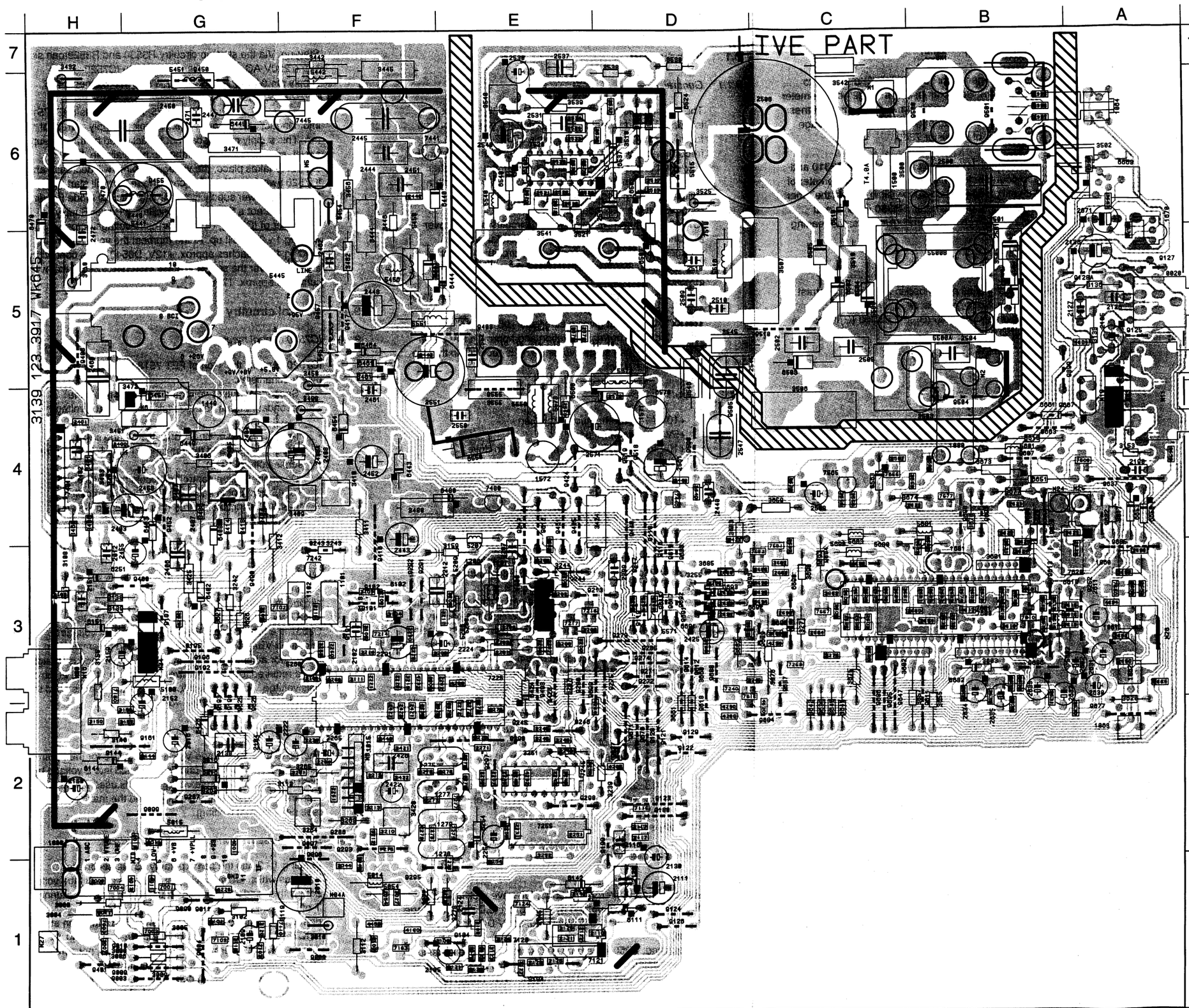
## CRT-PANEL




| | | | | | |
|---|---|---|---|---|---|
| 3382 | B4 * | 3350 | B1 | 7340 | A1 |
| 3362 | B4 * | 3332 | B3 | 9354 | A1 |
| 3324 | A4 * | 3311 | B1 | 7320 | A4 |
| 3383 | B4 * | 3352 | B1 | 3322 | A4 |
| 3344 | B1 * | 3335 | B3 | 3353 | B1 |
| 3360 | B4 * | 3312 | B1 | 6354 | B2 |
| 3343 | B1 * | 3354 | B1 | 9373 | A3 |
| 4360 | B4 * | 2344 | B1 | 9353 | B1 |
| 3357 | B1 * | 3355 | B2 | L3 | A3 |
| 3304 | A1 * | 9317 | B4 | L5 | A3 |
| 4334 | B4 * | 3351 | B1 | 3321 | A4 |
| 3380 | B4 * | 6314 | B2 | 3323 | A4 |
| 3381 | B4 * | 2373 | A3 | 2324 | A4 |
| 3333 | B4 | 3313 | A1 | 7300 | A1 |
| 2301 | B4 | 9313 | A1 | 6310 | A1 |
| 6330 | B3 | 2370 | A3 | L7 | A4 |
| 9330 | B3 | L4A | A2 | 3374 | A3 |
| 3314 | B2 | 2304 | A1 | 9310 | A1 |
| 9333 | B4 | 9391 | A2 | L6 | B3 |
| 9392 | B2 | 6334 | A4 | | |
| 5301 | B4 | 7310 | A2 | * = smd | |
| 9301 | B4 | 9370 | A3 | component | |
| 7330 | B3 | 5370 | A3 | | |
| 6350 | B1 | 9390 | A2 | | |
| 9350 | B1 | 3370 | A4 | | |
| 7360 | B4 | 5373 | A3 | | |
| 3361 | B4 | 3372 | A3 | | |
| 3300 | B4 | 3371 | A2 | | |
| 3340 | B4 | 9314 | A1 | | |
| 3331 | B3 | 3303 | A1 | | |
| 3315 | B2 | L4 | A2 | | |
| 3330 | B3 | 7350 | A1 | | |
| 3310 | B1 | 3334 | A4 | | |

# Mono carrier / Hauptplatine / Châssis






| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0020 | A5 | 2455 | G3 | 3202 | E3 * | 3617 | A4 | 6142 | E1 | 9213 | E3 |
| 1000 | G1 | 2460 | H5 | 3203 | E3 * | 3618 | B4 | 6144 | H2 | 9217 | D3 |
| 1015 | F2 | 2461 | F4 | 3206 | E3 * | 3620 | A2 | 6151 | H3 | 9243 | F3 |
| 1060 | A3 | 2462 | F5 | 3207 | E3 | 3621 | B3 * | 6251 | H3 | 9244 | E3 |
| 1061 | A3 | 2470 | H6 | 3208 | E3 * | 3622 | B4 * | 6254 | E2 | 9245 | E2 |
| 1062 | A3 | 2471 | G6 | 3210 | F2 * | 3623 | B4 * | 6402 | G3 | 9246 | E2 |
| 1063 | A2 | 2472 | H5 | 3211 | F3 * | 3624 | B3 * | 6403 | G4 | 9247 | E4 |
| 1064 | A6 | 2500 | B6 | 3212 | F2 * | 3625 | B3 * | 6408 | G4 | 9252 | A3 |
| 1080 | B4 | 2501 | B5 | 3213 | F2 * | 3626 | G3 | 6424 | E3 | 9271 | D3 |
| 1101 | F3 | 2502 | C5 | 3214 | F3 * | 3627 | G3 | 6426 | G2 | 9272 | D3 |
| 1102 | F3 | 2504 | B5 | 3219 | F3 * | 3628 | G3 * | 6440 | F6 | 9273 | D3 |
| 1206 | E3 | 2505 | C5 | 3239 | E2 | 3630 | A2 * | 6441 | F5 | 9274 | D3 |
| 1207 | E3 | 2508 | C6 | 3240 | D3 * | 3631 | B2 * | 6443 | F4 | 9275 | D2 |
| 1275 | F2 | 2509 | D5 | 3242 | G3 | 3632 | B3 * | 6444 | F5 | 9285 | D3 |
| 1277 | F2 | 2510 | D5 | 3243 | F3 | 3633 | B3 * | 6445 | G6 | 9286 | F2 |
| 1278 | F2 | 2517 | D6 * | 3244 | E3 | 3634 | B3 * | 6449 | G4 | 9287 | G2 |
| 1279 | F2 | 2518 | D5 | 3245 | E2 * | 3635 | B2 * | 6451 | G4 | 9290 | E2 |
| 1449 | G4 | 2520 | E6 * | 3248 | E2 * | 3636 | B2 * | 6454 | F4 | 9291 | F3 |
| 1500 | C6 | 2521 | E6 * | 3249 | E2 * | 3638 | C2 * | 6461 | F5 | 9292 | F3 |
| 1571 | D4 | 2522 | E6 * | 3250 | E2 * | 3639 | B3 * | 6464 | F5 | 9293 | F2 |
| 1572 | E4 | 2524 | E6 * | 3251 | E2 | 3640 | C2 | 6470 | H6 | 9295 | E1 |
| 1670 | A5 | 2529 | E6 * | 3252 | E2 * | 3641 | C2 | 6480 | F4 | 9297 | E2 |
| 1681 | B3 | 2530 | E6 | 3253 | E2 * | 3642 | C2 | 6500 | B5 | 9298 | E2 |
| 1900 | E3 | 2531 | E6 | 3254 | E1 * | 3650 | A3 * | 6501 | B5 | 9400 | H3 |
| 2008 | H1 * | 2532 | E6 * | 3255 | D3 * | 3653 | A4 * | 6502 | C5 | 9403 | F5 |
| 2010 | F1 | 2533 | E6 * | 3256 | D3 * | 3654 | B3 * | 6503 | C5 | 9405 | E4 |
| 2011 | G2 * | 2534 | E6 * | 3257 | D3 * | 3655 | B2 | 6504 | C5 | 9406 | H5 |
| 2012 | H3 | 2537 | E7 | 3259 | F3 * | 3656 | A3 * | 6505 | C5 | 9410 | F4 |
| 2013 | G2 * | 2540 | E6 | 3260 | F3 * | 3657 | C2 | 6507 | D5 | 9417 | F5 |
| 2016 | G2 | 2541 | D6 | 3261 | F2 * | 3658 | A3 * | 6508 | D6 | 9424 | E4 |
| 2044 | F1 * | 2545 | D5 | 3262 | G2 | 3659 | C4 | 6510 | C6 | 9428 | E3 |
| 2054 | F1 * | 2547 | D4 | 3263 | F2 | 3660 | D2 | 6524 | D6 | 9440 | D4 |
| 2101 | F3 * | 2550 | E4 | 3264 | F2 | 3661 | D2 | 6537 | D6 | 9450 | G6 |
| 2102 | F3 | 2551 | F5 | 3265 | F2 | 3662 | D3 | 6540 | E6 | 9452 | G4 |
| 2103 | G1 * | 2552 | E5 | 3270 | C3 * | 3663 | A6 * | 6550 | E4 | 9455 | G6 |
| 2104 | G2 | 2560 | E4 * | 3271 | C3 | 3664 | A3 * | 6560 | E4 | 9457 | F5 |
| 2105 | E1 | 2561 | D4 | 3272 | E2 * | 3666 | C3 * | 6563 | C4 | 9461 | E4 |
| 2106 | F1 * | 2563 | C4 | 3273 | E2 * | 3667 | A6 * | 6570 | D4 | 9490 | G4 |
| 2107 | F1 * | 2570 | D4 * | 3275 | F2 * | 3668 | C3 * | 6600 | B4 | 9491 | H1 |
| 2108 | F3 * | 2571 | E4 | 3276 | F2 * | 3669 | C3 * | 6610 | B3 | 9493 | E3 |
| 2109 | G1 | 2572 | E5 * | 3277 | F1 | 3670 | B4 | 6632 | B3 | 9500 | B6 |
| 2110 | E1 * | 2602 | A3 | 3278 | F1 | 3671 | A5 * | 6650 | A4 | 9501 | B6 |
| 2111 | D1 | 2603 | C3 * | 3279 | F1 * | 3673 | B4 | 6651 | B4 | 9504 | B4 |
| 2116 | D2 | 2610 | B3 * | 3280 | D3 * | 3674 | C4 | 6653 | A4 | 9505 | D4 |
| 2117 | E1 | 2611 | A3 | 3400 | H4 | 3675 | C3 | 6661 | B4 | 9510 | C5 |
| 2120 | D1 | 2613 | B3 * | 3401 | H4 | 3676 | C3 | 6663 | A6 | 9518 | D4 |
| 2121 | E1 * | 2615 | B3 * | 3402 | H4 | 3677 | B4 | 6690 | C3 | 9519 | D4 |
| 2122 | E1 * | 2620 | B3 * | 3403 | H4 | 3681 | C3 * | 6691 | D3 | 9522 | D6 |
| 2124 | E1 | 2621 | B4 * | 3404 | G4 | 3682 | C3 * | 6692 | D3 | 9555 | E4 |
| 2125 | E1 * | 2622 | C4 * | 3405 | G4 | 3683 | D4 | 6693 | D3 | 9590 | D4 |
| 2126 | A5 | 2623 | A3 * | 3406 | G4 | 3684 | C3 * | 7001 | G1 * | 9602 | A4 |
| 2127 | A5 | 2630 | A3 | 3407 | G4 | 3685 | D3 | 7002 | G1 * | 9607 | B4 |
| 2129 | E1 * | 2631 | A3 | 3408 | G4 | 3686 | C3 * | 7003 | H1 * | 9608 | D3 |
| 2130 | D1 | 2632 | B3 | 3409 | F4 | 3690 | C3 | 7004 | H1 * | 9610 | D3 |
| 2135 | A5 | 2633 | B3 | 3410 | F4 | 3694 | C3 * | 7102 | G3 * | 9611 | B2 |
| 2136 | A5 | 2634 | B3 | 3411 | F4 | 3695 | C3 * | 7109 | G1 * | 9612 | D3 |
| 2138 | A2 | 2635 | B3 | 3412 | G4 | 3696 | C3 * | 7110 | G1 * | 9613 | B3 |
| 2150 | H2 | 2639 | B3 * | 3414 | G4 | 3697 | C3 | 7116 | D2 * | 9614 | D3 |
| 2151 | H3 | 2650 | A3 * | 3418 | G4 | 3698 | C3 * | 7120 | E1 | 9615 | D3 |
| 2152 | G2 | 2652 | A3 * | 3420 | F2 | 3995 | B6 * | 7121 | E1 | 9616 | E4 |
| 2159 | H3 | 2653 | A3 * | 3421 | F2 * | 3996 | B6 * | 7124 | E1 * | 9617 | D3 |
| 2190 | A4 | 2662 | D3 * | 3422 | F2 * | 3997 | B6 * | 7150 | A3 * | 9618 | D2 |
| 2200 | E3 * | 2664 | C3 * | 3424 | G4 | 4000 | H1 * | 7183 | F1 * | 9620 | B4 |
| 2207 | E3 | 2665 | C3 * | 3425 | G3 | 4001 | G2 * | 7214 | F3 * | 9625 | G2 |
| 2208 | F3 * | 2666 | C3 * | 3427 | D4 * | 4011 | G1 * | 7215 | F2 * | 9626 | G2 |
| 2212 | F3 | 2670 | B3 * | 3428 | F2 * | 4013 | H1 * | 7216 | E3 * | 9627 | D2 |
| 2213 | F2 * | 2671 | A6 | 3432 | H6 | 4160 | F1 * | 7217 | E3 * | 9637 | A4 |
| 2221 | F3 * | 2674 | B3 * | 3440 | D4 * | 4200 | F3 * | 7225 | F3 | 9647 | C2 |
| 2222 | F2 | 2680 | C3 * | 3441 | D4 * | 4205 | G2 * | 7240 | D3 * | 9663 | B4 |
| 2224 | F3 | 2681 | B3 * | 3442 | F7 | 4226 | G1 * | 7242 | F3 | 9667 | B4 |
| 2225 | F3 * | 2682 | B3 * | 3443 | F5 * | 4279 | E2 * | 7245 | E2 | 9670 | D2 |
| 2228 | F3 * | 2683 | B3 * | 3444 | F6 | 4280 | D2 * | 7255 | E2 | 9671 | D2 |
| 2230 | F2 * | 2684 | C3 * | 3445 | F7 | 4284 | E2 * | 7269 | C3 * | 9677 | A2 |
| 2231 | E2 * | 2685 | B3 * | 3446 | F6 | 4289 | E3 * | 7277 | E2 * | 9684 | C2 |
| 2243 | E2 * | 2686 | D3 * | 3450 | F5 | 4290 | D2 * | 7278 | E1 * | 9685 | A3 |
| 2245 | E2 * | 2687 | C3 * | 3451 | G4 | 4292 | E2 * | 7279 | E2 * | 9686 | C2 |
| 2246 | E2 * | 2690 | C3 * | 3454 | F6 | 4293 | F3 * | 7401 | H4 * | 9687 | C3 |
| 2248 | E2 * | 2691 | D3 * | 3456 | F6 | 4294 | C3 * | 7440 | H4 * | 9688 | D3 |
| 2249 | E2 * | 2692 | D3 * | 3460 | H4 | 4296 | F2 * | 7441 | F6 | 9689 | D3 |
| 2251 | E2 * | 2693 | D3 * | 3461 | F5 | 4455 | F1 * | 7445 | G6 | 9690 | C3 |
| 2254 | E2 | 2694 | C3 * | 3462 | F5 | 4601 | B3 * | 7480 | E4 | 9691 | D3 |
| 2256 | E2 * | 3000 | H1 | 3470 | H5 | 4602 | B3 * | 7518 | D5 | 9692 | D3 |
| 2257 | E2 * | 3004 | H1 | 3471 | G6 | 4604 | A5 * | 7520 | E6 | 9693 | D3 |
| 2260 | F3 * | 3005 | G1 | 3472 | G4 | 4605 | C3 * | 7565 | C4 | 9694 | C3 |
| 2261 | F2 * | 3006 | G1 | 3480 | F4 | 4613 | B3 * | 7566 | C4 * | 9695 | C2 |
| 2264 | F2 * | 3007 | H1 * | 3499 | F4 | 4617 | B3 * | 7600 | B3 | 9696 | B3 |
| 2265 | F2 | 3008 | G1 | 3500 | B6 | 4622 | C4 * | 7601 | B3 | 9697 | B4 |
| 2270 | E2 * | 3009 | G1 | 3501 | B6 | 4630 | C2 * | 7608 | A4 * | 9698 | B4 |
| 2271 | E2 * | 3010 | F1 | 3502 | A6 | 4681 | B3 * | 7610 | B3 * | 9699 | E3 |
| 2272 | E2 * | 3011 | H1 * | 3503 | B5 | 4682 | B3 * | 7616 | B3 * | 9899 | B5 |
| 2273 | E2 * | 3016 | G2 | 3504 | C5 | 4683 | B3 * | 7620 | B3 | 9900 | H5 |
| 2275 | E2 * | 3027 | F1 * | 3505 | B5 | 4687 | E3 * | 7650 | A3 * | 9901 | H4 |
| 2277 | F2 * | 3044 | F1 * | 3506 | C4 | 4694 | A3 * | 7667 | C3 * | 9902 | H2 |
| 2278 | F2 * | 3101 | G1 * | 3507 | C5 | 4695 | C3 * | 7677 | B4 * | 9903 | H4 |
| 2279 | F2 * | 3102 | G1 | 3510 | C5 | 5014 | F1 | 7681 | C3 * | 9904 | H2 |
| 2280 | D3 * | 3104 | F3 * | 3512 | E6 * | 5047 | C5 | 7682 | D3 * | 9905 | H3 |
| 2281 | E3 * | 3105 | G3 * | 3513 | E6 * | 5054 | F1 | 9003 | G1 | 9906 | H3 |
| 2282 | F3 * | 3106 | F3 * | 3517 | D6 * | 5100 | G3 | 9004 | G1 | 9907 | H3 |
| 2283 | E3 * | 3107 | F3 * | 3518 | D6 | 5206 | E3 | 9008 | F1 | M1 | C6 |
| 2284 | D3 * | 3108 | H3 * | 3520 | E6 * | 5207 | E4 | 9009 | G1 | M11 | A4 |
| 2285 | D3 * | 3109 | H3 * | 3521 | E5 | 5209 | E3 | 9010 | G1 | M16 | H3 |
| 2286 | E3 * | 3110 | G1 * | 3525 | D6 | 5260 | F3 | 9011 | G1 | M19 | A4 |
| 2287 | E3 * | 3111 | F3 * | 3528 | D6 | 5286 | E3 | 9090 | G1 | M2 | B5 |
| 2288 | E3 * | 3112 | F1 | 3529 | D6 | 5287 | E3 | 9097 | F2 | M24 | B4 |
| 2290 | F3 * | 3113 | F2 | 3530 | D7 | 5288 | E3 | 9098 | F1 | M25 | A4 |
| 2291 | F3 | 3116 | F3 * | 3532 | E6 * | 5441 | G6 | 9099 | G2 | M26 | A3 |
| 2299 | D3 | 3117 | D2 * | 3534 | E6 * | 5442 | F6 | 9101 | F3 | M27 | H1 |
| 2400 | H4 * | 3118 | F3 | 3536 | E6 * | 5443 | G6 | 9102 | F3 | M30 | H3 |
| 2401 | H4 * | 3119 | G1 | 3537 | D6 * | 5445 | G5 | 9104 | F1 | M33 | A4 |
| 2402 | H4 | 3120 | G1 * | 3538 | D6 | 5451 | G6 | 9116 | D4 | M34 | G3 |
| 2403 | H4 | 3121 | E1 * | 3539 | E6 | 5456 | F5 | 9118 | D4 | M4 | G4 |
| 2404 | G4 | 3122 | E1 * | 3540 | E6 | 5457 | F5 | 9119 | D3 | M5 | F6 |
| 2406 | G3 | 3123 | E1 * | 3541 | E6 | 5458 | F5 | 9120 | D2 | M8 | G4 |
| 2407 | G4 | 3124 | E1 * | 3542 | C7 | 5500 | B5 | 9121 | D2 | M7 | E3 |
| 2408 | F4 | 3125 | E1 * | 3545 | D5 | 5515 | D6 | 9122 | D2 | M8 | F2 |
| 2408 | F4 | 3127 | E1 * | 3546 | D5 | 5516 | D5 | 9123 | D2 | M84A | F1 |
| 2421 | F2 * | 3129 | E1 * | 3555 | E4 | 5540 | E6 | 9124 | D1 | SK1 | B6 |
| 2422 | F2 | 3135 | A5 | 3565 | B4 * | 5545 | E5 | 9125 | A5 | | |
| 2423 | F2 * | 3136 | A5 | 3566 | C4 * | 5550 | E4 | 9126 | D1 | | |
| 2424 | E2 * | 3138 | H3 | 3567 | C4 * | 5551 | F5 | 9127 | A5 | | |
| 2425 | D3 | 3139 | H3 | 3568 | C4 * | 5570 | D5 | 9128 | A5 | | |
| 2426 | F2 | 3140 | H2 | 3569 | C4 * | 5571 | D3 | 9129 | D2 | | |
| 2427 | F2 * | 3142 | E1 * | 3570 | E5 * | 5572 | D5 | 9144 | H2 | | |
| 2440 | D4 | 3144 | G2 * | 3601 | B3 | 5573 | E4 | 9161 | H2 | | |
| 2442 | F6 * | 3145 | E1 | 3602 | C3 | 5601 | B4 | 9180 | D2 | | |
| 2443 | F4 | 3150 | H2 * | 3603 | B3 | 5602 | B3 | 9191 | F3 | | |
| 2444 | F6 | 3153 | A4 | 3604 | C3 * | 5620 | B4 | 9192 | G3 | | |
| 2445 | F6 | 3155 | H3 | 3605 | C3 * | 5680 | B3 | 9193 | G2 | | |
| 2446 | F2 * | 3157 | H2 * | 3606 | C3 * | 5681 | B4 | 9194 | E1 | | |
| 2447 | G6 | 3158 | H2 * | 3610 | B3 * | 5683 | C4 | 9195 | G3 | | |
| 2448 | F5 | 3159 | E3 | 3612 | B3 * | 5690 | C3 | 9196 | G3 | | |
| 2450 | H6 | 3170 | E1 * | 3613 | B3 * | 6016 | G2 | 9197 | G3 | | |
| 2451 | F6 | 3188 | E1 * | 3614 | B3 * | 6102 | F3 | 9198 | G2 | | |
| 2452 | F4 | 3200 | E3 * | 3615 | B3 * | 6110 | E1 | 9199 | D2 | | |
| 2453 | G4 | 3201 | E3 * | 3616 | B3 * | 6111 | D1 | 9200 | E3 | | |

# 8. Electrical adjustments

## 8.1 Settings on the carrier panel

*8.1.1 +95V supply voltage*

Connect a multimeter (DC) across C2531. Set brightness at mid position and contrast at maximum. Apply a pattern generator with a colour bar. Adjust potentiometer **R3540** to +95V ± 0.5V DC.

*8.1.2 Horizontal centring*

Is adjusted with potentiometer **R3420**.

*8.1.3 Vertical centring*

Can be adjusted with **R3409**.

*8.1.4 Picture height*

Is adjusted with potentiometer **R3410**.

*8.1.5 Focusing*

Is adjusted with the focusing potentiometer in the line output transformer 5445 (if necessary set brightness at minimum and contrast at maximum for focus adjustment).

*8.1.6 RF AGC adjustment*

Connect a pattern generator (e.g. PM5518) to the aerial input with RF signal amplitude = 1 mV. Connect a multimeter (DC) at pin 1 of tuner. Adjust **R3264** so that voltage at pin 1 of tuner is 3.3 ± 0.2V DC.

*8.1.7 Picture demodulator adjustment*

Connect a pattern generator (e.g. PM5518) with a cross hatch. Connect an oscilloscope (1ms/div) to pin 7 of IC7225-6A and adjust **L5260** so that the overshoot response is minimum, see Fig. 8.1.
Select a colour bar signal and verify if the picture is all right.

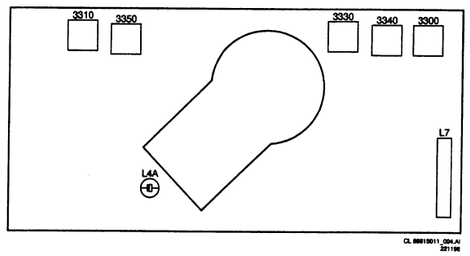



**Fig. 8.1**

## 8.2 Settings on the CRT panel

*8.2.1 Vg2 cut off adjustment*

Connect a pattern generator (e.g. PM5518) and set it to white raster pattern. Set contrast and the Vg2 potentiometer (in line output transformer) minimum. Adjust with brightness control the top video level at pin 4L7 to the same voltage level of the emitter of transistor 7360.

Pre-adjust the black level preset potentiometer **R3310** and **R3350** fully counter-clockwise. Adjust Vg2 potentiometer of LOT 5445 until green just becomes visible. Adjust the other two guns with their potentiometer: **R3350** for blue and **R3310** for red. All three colour shall give the same reading for a white picture.

*8.2.2 White-D adjustment*

Use the same signal as prescribed in 2.1. Adjust contrast to such a level that red is good visible.
Adjust potentiometers **R3340** (B) and **R3300** (G) to have a correct White-D picture.



# 9. Circuit description new circuitries

Power supply (diagram A1)

## 9.1 Introduction

*9.1.1 General*

The L7 switched mode power supply (SMPS) is mains isolated. The control IC7520 (MC44603P) gives the pulses for driving FET 7518 with duty cycle control at a fixed frequency of nominal 70 kHz in normal operation (in standby, slow-start and overload situation the SMPS runs at other frequencies than these 70 kHz). This SMPS works with a switching FET, no opto-coupler and no thyristor switching windings on the secondary side.
IC7520 is featured with a slow-start circuitry and has over- and undervoltage-protection of the secondary supply voltages. Unload and overload (short-circuit) protection is also included. In case the load decreases under a certain threshold level the SMPS will switch into standby-mode (in standby the SMPS is in the so called "reduced frequency mode"; nominal 20 kHz).
The +VBATT output gives a stabilised +95V for 14" and +100V for 21" in normal operation and approx. 115V DC in standby mode (the supply voltage +8V is "down", so the line output is shut "down").

*9.1.2 Output voltages*

- +10V / 14V for the audio amplifier
- +5V for the control part
- +10V for the horizontal synchronisation drive
- +95V for the line output stage

*9.1.3 Duty cycle and T-on, T-off, T-dead*

The duty cycle of the power supply depends on T-on of FET TS7518 which is controlled by pin 3 of IC7520. The IC detects the variations of the +VBATT (the secondary side of T5545) via sensing-winding 1-2 at the primary side of T5545. The switching period of FET 7518 is divided in three main areas; T-on, T-off and T-dead (see Fig. 9.1).

- During T-on FET 7518 conducts and so the energy which is extracted from the mains, is stored into the primary winding 4-7 of transformer T5545 with a linear increasing primary current (slope depends on the voltage across C2508). Via T-on regulation by pin 3 IC7520 the duty cycle of the SMPS and so the +VBATT is controlled.
- During T-off FET 7518 does not conduct and so all energy "inside" the transformer is supplied to the load via secondary windings of T5545 and the secondary diodes (D6550, D6560 and D6570). The current through the secondary side of the transformer decreases with a linear slope (slope depends on the voltage at the secondary side of T5545).
- During T-dead FET 7518 does not conduct and so no energy is extracted or supplied ($I_{sec}$ is zero).

## 9.2 Primary side

*9.2.1 Mains input and degaussing*

Mains voltage is filtered by L5500, full wave rectified by a diode bridge and smoothed by C2508 to the DC input voltage for the SMPS at pin 7 of T5545 (e.g. 300V DC for 220V AC mains).
Degaussing: R3504 is a dual PTC (2 PTC's in one housing). After switching "on" the set, the PTC is cold so low-ohmic and so the degaussing current is very high. After degaussing, the PTC is heated, so high-ohmic, so in normal operation the degaussing current is very low.

*9.2.2 Start up and take over*

Start-up: Via the start-up circuitry R3530 and R3529 one side of the 220V AC mains is used to start-up IC7520 via the supply pin ($V_{pin1}$). As long as $V_{pin1}$ has not reached 14V5, IC7520 does not start up and only sinks 0.3 mA;
As soon as $V_{pin1}$ reaches the 14V5, IC7520 starts (FET 7518 into conduction) and pin 1 sinks a typical supply current of 17 mA. This supply current can not be delivered by the start-up circuit, so a take-over circuit has to be available. If no take-over takes place, the voltage on pin 1 will decrease and IC7520 switches off. In that case the restart will start again.
Note; This power supply is a SMPS (Switched Mode Power Supply) but not a SOPS (Self Oscillating Power Supply).
Take over of IC7520; During start-up a voltage across winding 1 - 2 is built up. At the moment the voltage across winding 1 - 2 reaches approx. +12V, D6540 starts conducting and takes over the supply voltage $V_{pin1}$ of IC7520 (take over current is approx. 17 mA).

## 9.3 Control circuitry

*9.3.1 IC7520 control mechanisms*

IC7520 controls the T-on of FET 7518 in all operation modes by 3 mechanisms:

- "Secondary-output-voltage-sensing" controls the secondary output voltages (via the feedback voltage $V_{pin14}$).
- "I-prim current sensing" controls both the secondary output voltages and the maximum I-prim (via the current sense voltage $V_{pin7}$).
- "Demagnetisation control" prevents the transformer T5545 from going into saturation via the so called "DEMAG" function at pin 8 (this causes slow-start operation).

*9.3.2 Secondary output voltages feedback (pin 14 of IC7520)*

Winding 14 - 12 has the same polarity as the secondary windings which are supplying the load. During T-off the secondary windings and so winding 14 - 12 are positive. D6537 conducts and so charges C2537; the DC level across C2537 is a reference for the secondary output voltages (e.g. the +VBATT). Via R3538, R3539 and potentiometer R3540 (for adjusting the +VBATT) this DC-voltage is brought to the required level for the error amplifier in IC7520 at pin 14. This voltage $V_{pin14}$ is called feedback voltage and is used to control the secondary output voltages.

*9.3.3 I-prim sensing (pin 7 of IC7520)*

The current sense voltage $V_{pin7}$ is a measure for the I-prim through FET 7518. The I-prim is converted into a voltage by R3518. The current sense voltage $V_{pin7}$ is used to control both the secondary output voltages and the maximum I-prim (see peak current limiting).

*9.3.4 Demagnetisation control (via pin 8 of IC7520)*

Winding 1 - 2 has the same polarity as the secondary windings which are supplying the load. As a result the voltage across this winding is negative during T-on, positive during T-off and oscillating during T-dead. The so called demagnetisation (block "DEMAG" in IC7520) function at pin 8 of IC7520 is used for blocking the output $V_{pin3}$ during the time that there is still energy in the transformer ($I_{sec}$ not zero). This is realised by delaying the T-on until the demagnetisation is completely finished. In this way the currents and voltages at the moment of switching "on" the FET are controlled.

# Circuit description new circuitries

*9.3.5 IC7520 control (see Fig. 9.2 and Fig. 9.3)*

The error amplifier (block A in Fig 9.2) compares the feedback voltage $V_{pin14}$ with an internal reference voltage of 2V5. The output voltage $V_{error\text{-}out}$ of this error amplifier is fed to another comparator (block B in Fig 9.2). This comparator compares the $V_{error\text{-}out}$ and the current sense voltage $V_{pin7}$. As soon as the current sense voltage $V_{pin\ 7}$ becomes higher than the output-voltage of the error amplifier $V_{error\text{-}out}$, the comparator B gives a spike (the output of comparator B is the so called current sensing output-voltage $V_{cs\ out}$).

*9.3.6 Flip flop*

Flip flop (block C in Fig 9.2) drives the output pin 3 ($V_{pin3}$) via a buffer amplifier (block D). The flip flop is set by positive edge of the output of the oscillator ($V_{osc}$) and reset by the spike $V_{cs\ out}$. As a result the pulse $V_{pin3}$ becomes "high" (T-on starts) by the positive edge of $V_{osc}$ from the internal oscillator and "low" (T-on stops) by the spike of $V_{cs\ out}$ (the T-on start will be delayed in case the transformer is not yet demagnetised; see the slow-start procedure).

*9.3.7 Stable load and increasing / decreasing load (see Fig. 9.3);*

In case of a stable load, the feedback voltage $V_{pin14}$ (and so also the maximum current sense voltage $V_{pin7}$) remains the same. As a result the T-on and so the duty cycle will remain the same.
In case of an increasing load, the secondary output voltages decreases. The voltage on pin 14 would like to decrease which causes $V_{error\text{-}out}$ to increase. As a result comparator B will give the pulse later; $V_{pin3}$ will be "high" for a longer period (longer T-on so the duty cycle increase) and so the secondary output voltages will be increased (corrected). This will give a new balance of feedback voltage $V_{pin14}$ and the internal 2V5 reference voltage, at a new larger duty cycle.
As a result of the longer T-on, the maximum I-prim increases, so more energy can be stored in the transformer. In this way more energy will be supplied to the load.
In case of a decreasing load, the secondary output voltages increases. The voltage on pin 14 would like to increase which causes $V_{error\text{-}out}$ to decrease. As a result comparator B will give the pulse earlier; $V_{pin3}$ will be "high" for a shorter period (shorter T-on so the duty cycle decrease) and so the secondary output voltages will be decreased (corrected). This will give a new balance of feedback voltage $V_{pin14}$ and the internal 2V5 reference voltage, at a new smaller duty cycle.
As a result of the shorter T-on, the maximum I-prim decreases, so less energy can be stored in the transformer. In this way less energy will be supplied to the load.
In case the demagnetisation of the transformer is not finished, the positive edge from the oscillator, which will start a new cycle, will be overruled (via buffer block D) as being the starting point of T-on. As a result the T-on will be delayed and so the frequency of the SMPS will go down. This procedure is used during start-up.

*9.3.8 Peak current limiting*

Peak current limiting is realised by an internal clamp at $V_{pin7}$ at 1V DC. Via this clamp the $V_{pin7}$ can never exceed 1V DC and so the maximum value of I-prim (maximum current through FET 7518) is determined.
In case the load needs more than the maximum power, by then the I-prim is already at his maximum level so the SMPS will go in overload protection (see foldback principle explained at overload protection).

*9.3.9 Cycle-by-cycle control*

The T-on control is controlled on a cycle-by-cycle basis (because of the flip flop block C in IC7520). This means that in every cycle the T-on is determined again. By doing so the secondary voltages control, peak current limitation and all protections can be very accurate and fast.

*9.3.10 Slow-start*

As soon as $V_{pin1}$ > 14V5 DC the SMPS will start-up. This will be done by a slow-start procedure (both the frequency and the duty cycle will be built up during slow-start). The following 3 phenomena's take place during start-up:

- The frequency will slowly increase up to the nominal frequency (70 kHz for normal operation and 20 kHz for standby). This is realised via the demagnetisation function at pin 8; via this "DEMAG" function, FET 7518 will only be driven into conduction (T-on will only become "high") when T5545 is totally demagnetised.
- The voltage at pin 5 determines the foldback point. As during start-up this $V_{pin5}$ is gradually built-up, the foldback point will also gradually increase (see foldback principle explained at overload protection).
- The duty cycle will slowly increase beginning at the absolute lowest duty cycle possible. The maximum duty cycle is determined by C2530 at pin 11 IC7520; as C2530 is uncharged at start-up, the power supply starts up at the lowest possible duty cycle.

*9.3.11 Standby mode*

In standby mode the load decreases (see description of standby on the secondary side) under a certain threshold level. The SMPS will determine this threshold level and so switch to the so called "reduced frequency mode" at 20 kHz. This minimal load threshold level is determined by R3532 at pin 12 (in the L7 the SMPS does not have a burst mode in standby, only a reduced frequency mode).
70 kHz; In normal operation mode the internal oscillator gives 70 kHz. This frequency is controlled by C2531 at pin 10 IC7520 and by R3537 pin 16 IC7520.
20 kHz; In standby mode the internal oscillator gives 20 kHz. This frequency is controlled by R3536 at pin 15 IC7520.

*9.3.12 FET 7518 gate regulation*

D6524 prevents pin 3 of IC7520 from becoming negative (this will destroy the IC) due to stray inductance in the gate part. The safety resistor R3525 limits the drive current to the gate of FET 7518.

*9.3.13 Typical values for the L7 chassis*

In a stable situation $V_{pin14}$ is typical 2V5.

| | | |
|---|---|---|
| Mains Voltage: | 110V | |
| | 220 - 240V | |
| | 150 - 276V | |
| | 90 - 276 V | |
| Mains frequency: | 50 Hz | |
| | 60 Hz | |
| Power Consumption in normal mode: | 14": | 43 W +/- 10% |
| | 20": | 52 W +/- 10% |
| | 21": | 57 W +/- 10% |
| Power Consumption in stand-by mode: | < 10W | |
| | < 3W option. | |

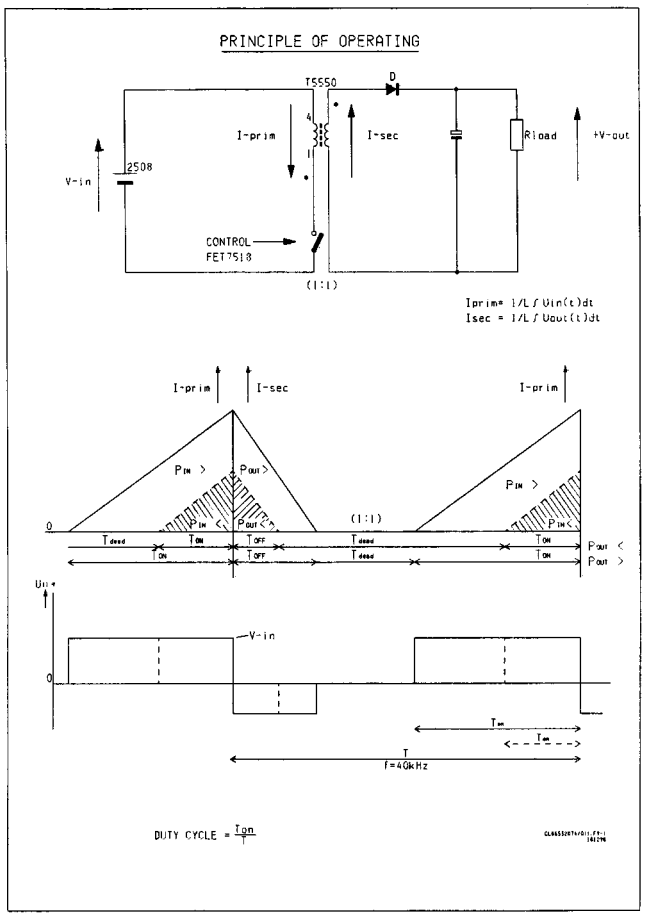



Fig. 9.1

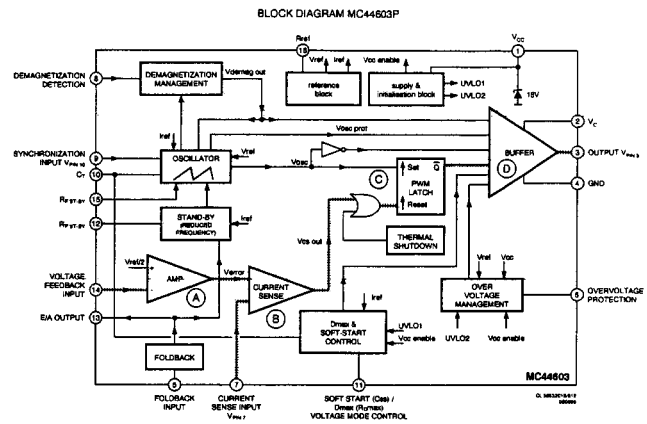



Fig. 9.2

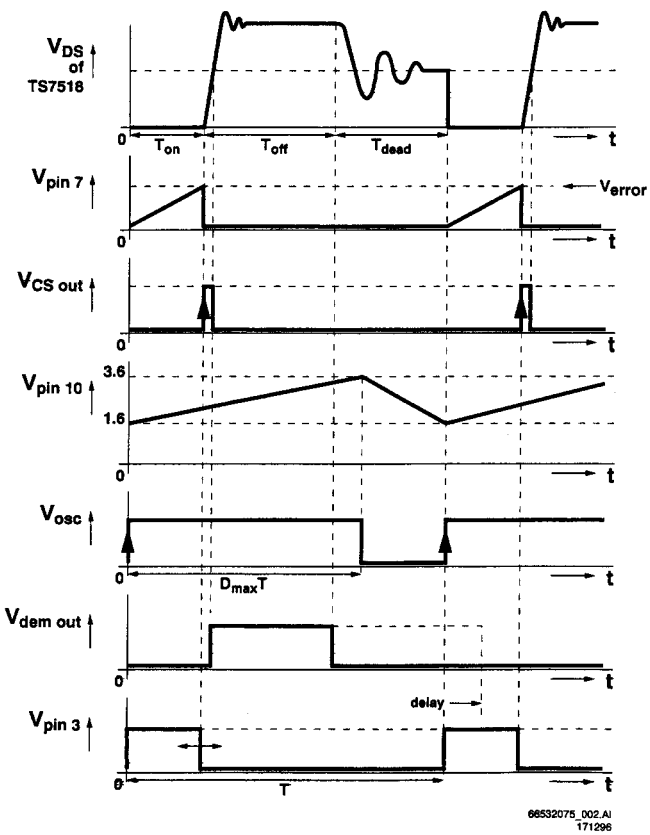



Fig. 9.3

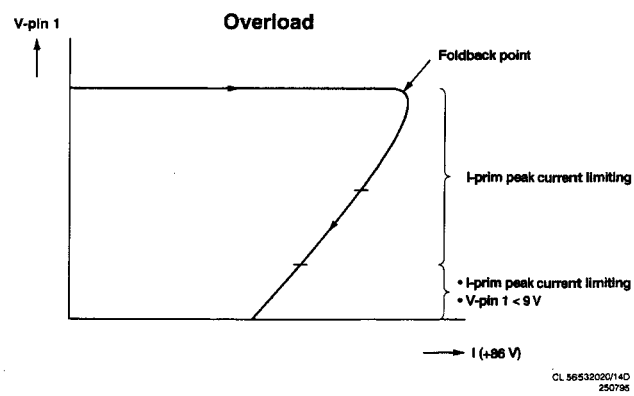



Fig. 9.4

# Circuit description new circuitries

Pin 38 is both SANDCASTLE output and HORIZONTAL FLYBACK input and PROTECTION input. Selection between input and output is automatically determined by the values of the current by R3456,R3462 and R3461:

- The SANDCASTLE has an output current a few mA; the amplitudes of sandcastle pulse; burst 5V3, line blanking is 3V, frame blanking 2V.
- When the input acts as a HORIZONTAL FLYBACK pulse, the input has a current of 100-300 mA. This horizontal flyback pulse compares phase of flyback pulse with phase of the horizontal oscillator. If the phase is not correct the duty cycle of horizontal oscillator will be adjusted.
- The PROTECTION signal from the frame amplifier (pin 7 IC7401 diagram A2) will be constantly "high" (see description frame amplifier) in case of no vertical deflection current. This constant "high" level will overrule the "normal" SANDCASTLE signal and so the picture will become "black".

*9.6.2 The line output circuitry*

In principal the line output stage is the same as used in the Anubis S: Pin 37 IC7225-6E drives the line output stage, TS7445 and transformer 5445 via drivers TS7440-7441. The line output stage supplies the deflection current and the following supply voltages (see also the power supply block diagram in chapter 5):

- EHT, +160, Vg2, focus and ff for the picture tube.
- +5V5 for the tuner and to create +VB for band switching.
- +9V for making the supply voltage +8V and +8VI.
- +8V and +8VI for the supply of the IC7225.
- +26V for the frame amplifier and the IC7225.

*9.6.3 Principle working of the line output stage (see Fig 9.5)*

The voltage across C2450 is constantly +95V DC. C2450 is charged by the +95V from the power supply via the primary winding 2-1 of the LOT (5445) and via R3454.

- Second half of the scan (t1-t2): During the second half of the scan the control voltage of TS7445 is positive, so TS7445 conducts. The horizontal deflection coil by then is switched in parallel with C2450 (constant +95V DC). As a result of this constant +95V DC a linear current is flowing through the horizontal deflection coil and TS7445. As soon as the control voltage of TS7445 becomes negative, TS7445 will not conduct any more and the second half of the scan is finished.
- First half of the flyback (t2-t3): During the first half of the flyback TS7445 does not conduct any more. The current which flows through the horizontal deflection coil, would like to remain flowing and so flows via C2445 bringing energy from the horizontal deflection coil to C2445. The current though the deflection coil will drop and the voltage across C2445 will rises sinusoidally.
- Second half of the flyback (t3-t4): During the second half of the flyback TS7445 still does not conduct. All energy which has been stored from the deflection coil into C2445 (during t2-t3) will be recovered to the deflection coil again during t3-t4. In other words, all energy in C2445 will be fed back to the horizontal deflection coil, so the voltage across C2445 drops and the current though the deflection coil will drop further (negative by now) sinusoidally.
- First half of the scan (t4-t5): At the end of the flyback (t4), the voltage at the cathode of the diodes D6445//D6447 parallel to TS7445 wants to become negative, so these diodes will conduct. Again the horizontal deflection coil by then is switched in parallel with C2450 (constant +95V DC). As a result of this constant +95V DC a linear current is flowing through the horizontal deflection coil and diodes D6445//D6447.
  At the end of the first half of the scan the voltage at the cathodes of the diodes D6445/D6447 will become 0V, so this diodes will stop conducting. Because of that, already before the end of the first half of the scan the control voltage $U_{BE}$ of TS7445 must be "high" again.

Horizontal flyback; The horizontal flyback pulse is brought to the correct DC level by R3456,R3462 and R3461.
D6461 prevents the pulse from becoming higher than 8V by clamping.
Horizontal S-correction to correct errors in horizontal linearity via C2450.

## 9.7 Vertical synchronisation IC7225-6E and the frame amplifier IC7401

*9.7.1 Synchronisation*

Vertical synchronisation separator separates frame synchronisation pulses from CVBS signal and synchronises frame oscillator. The amplitude of the sawtooth on pin 43 is controlled via pin 41 (VFB vertical feedback) which locks at the vertical scan across R3410.
Pre-amplifier in IC7225-6E amplifies sawtooth (pin 43 of IC7225-6E).

*9.7.2 Frame amplifier*

In principal the frame output stage is the same as used in the Anubis A: IC7401 (TDA3653) is used for the vertical deflection. This IC is controlled on pins 1 and 3 by the vertical control signal of IC7225-6E and a deflection current is generated on pin 5. The picture centring is set with the resistor 3409 and the picture amplitude can be set using potentiometer 3410. The vertical flyback signal is generated on pin 8 of the IC.

- During the scan the +26V supply voltage is used for the deflection current.
- During the flyback a flyback generator is used for the high dI/dt. During the scan, pin 8 IC7401 is 0V and so C2403 is charged to +26V. During flyback IC7401 gives a +26V pulse on pin 8 IC7401 and so pin 6 IC7401 has a 26+26=52V pulse during flyback. As a result D6403 is blocked during flyback. Since the flyback pulse at output pin 5 IC7401 is slower than at the input pin 1 IC7401 because of the self-inductance of the vertical deflection coil, a negative voltage is formed on pin 1 IC7401 during flyback. This negative voltage drives IC7401 to maximum, so the full 52V occurs on pin 5 IC7401 during flyback.
- Protection; In case of no deflection current, by then the flyback generator can not make +52V. As a result pin 8 will drop under 2V DC. If pin 8 drops under 2V DC the protection circuit inside IC7401 will be activated making the protection signal line on pin 7 IC7400 constant "high". This constant "high" protection will overrule the "normal" SANDCASTLE signal; the constant "high" SANDCASTLE signal will block the chrominance decoders (IC7225-6D and IC7245 in diagram A7) and so the picture will become "black".

## 9.4 Protections

*9.4.1 Overvoltage protection of the secondary voltages*

After start-up is the supply voltage $V_{pin1}$ taken over by positive winding 1-2, and so after start up $V_{pin1}$ is a measuring point for the secondary output voltages. After start-up (via an internal switch) this $V_{pin1}$ is internally tapped (voltage divided) to a voltage which can be measured at pin 6 (so $V_{pin6}$ is also a measuring point for the secondary output voltages).
As soon as the voltage $V_{pin6}$ > 2V5, the logic in IC7520 will shut down the output at pin 3. This 2V5 threshold at $V_{pin6}$, is equivalent to a $V_{pin1}$ of 16V DC which is equivalent to a voltage at the supply voltage +VBATT of approx. 108V DC (normal operation) and 130V DC (standby). After switching "off" because of overvoltage protection, the IC starts up again (see slow-start).
→ In case an overvoltage situation is sensed at the secondary output voltages, the SMPS will go in overvoltage protection. In case the overvoltage situation remains present, the SMPS will give overvoltage protection, slow-start, overvoltage protection, slow-start, etc. --> a very good audible hick-up mode.

*9.4.2 Undervoltage protection of the secondary voltages*

If the supply voltage $V_{pin\ 1}$ < 9V DC the output pulse at pin 3 will be shut down. As soon as $V_{pin1}$ < 7V5, the IC7520 will be totally shut "off". $V_{pin1}$ of 9V DC is equivalent to a voltage at +VBATT of approx. 70V DC (normal operation) and 95V DC (standby), $V_{pin1}$ of 7V5 is equivalent to a voltage at +VBATT of approx. 55V DC (normal operation) and 65V DC (standby).
→ In case an undervoltage is sensed at the secondary output voltages, the SMPS will first switch "off" the pulse and then switch "off" the complete IC7520.
In case the IC7520 is switched "off", the SMPS will switch "off". In case the undervoltage situation remains present, the SMPS will give undervoltage protection, slow-start, undervoltage protection, slow-start, etc. → a very good audible hick-up mode.

*9.4.3 Unload protection*

In case the load goes down (e.g. the line goes down because of standby mode or some failure in the line) this is detected by IC7520 via I-prim and secondary output voltages sensing. In case the load decreases below a certain threshold the SMPS will switch in "reduced frequency mode" of 20 kHz (this threshold is determined by the voltage level at pin 12 IC7520);
→ In case of an unload situation the set will switch to "low frequency mode" or standby mode.
Whether this unload situation of the SMPS is caused by the standby command or by a failure (e.g. in the line), can only be determined by switching on the set again which the remote control; in case of standby mode the TV will switch "on" again, in case of an unload situation the set will not switch "on".

*9.4.4 Overload (short-circuit) protection (see Fig. 9.4)*

If the secondary load becomes too high, I-prim becomes too high which is sensed by the current sense voltage $V_{pin7}$.
This voltage $V_{pin\ 7}$ is not allowed to exceed 1V DC by IC7520 and so gives current limiting. As the I-prim is limited, the secondary output voltages will also drop and so supply voltage $V_{pin1}$ will drop. As soon as $V_{pin1}$ < 9V DC the driving pulse at pin 3 will stop.

As a result of these 2 mechanism in case of an overload the secondary voltages will drop very fast. This is called the foldback mechanism; the foldback point can be adjusted by pin 5 IC7520 (for the L7 this point is adjusted to a maximum tolerable output power of 85W at 90Vac and 165W at 276VAC).
After this foldback, the IC starts up again (see slow-start).
In case the overload situation remains present, the SMPS will give foldback again, slow-start, foldback, slow-start, etc.;
→ As a result in case of a short-circuit (or overload) the TV will be in a very good audible hick-up mode.

## 9.5 Secondary side

*9.5.1 Output voltages*

See 9.1.2 for output voltages.

*9.5.2 Protections*

No protections are available at the secondary side.

General: IC7225 (TDA836X) is a single-chip video processor with built in IF-detector, luminance-chrominance-synchronisation separator, PAL chrominance decoder, video controller, horizontal & vertical synchronisation processor en FM sound-decoder.
IC7225 has 4 possible executions:
- TDA8360 is for PAL-only sets without external switch (no AV cinches)
- TDA8361 is for PAL-only sets with external switch (with AV cinches)
- TDA8362 is for PAL/SECAM multi sets with external switch (with AV cinches)
- TDA8363 is for NTSC only.

# Deflection and synchronisation (diagram A2 and A3)

## 9.6 Horizontal synchronisation IC7225-6E and the line output stage

*9.6.1 Synchronisation*

Start up of the horizontal oscillator via the +10V gives a start-up current into pin 36; if the voltage on pin 36 exceeds 5V6 the horizontal oscillator starts running at approx. 25kHz. Only when the supply pin of IC7225 (pin 10 at IC7225-6B in diagram A7) becomes 8V the line frequency changes to 15625 Hz.
Horizontal synchronisation separator separates horizontal pulses out of CVBS and so synchronises the free-running horizontal sawtooth generator.
Horizontal oscillator sawtooth is converted into square wave voltage with variable duty cycle. This square wave on pin 37 is fed to the line output stage. The time constant of the synchronisation circuit is automatically internally determined by IC7225-6E.

# Circuit description new circuitries

⇒ 4.43 MHz signal for locking the PLL and chrominance cloche filter of IC7245.

⇒ SECAM or PAL/NTSC operation switching signal (DC-controlled) to do an automatic selection between the output of IC7225-6C and IC7245.
If IC7225-6C has detected PAL or NTSC, pin 32 of IC7225-6C becomes 1V5 and the output becomes available at pin 30 and 31. If no PAL/NTSC is detected, pin 32 of IC7225-6C becomes 5V and the output will be disabled.
If a SECAM signal is detected pin 1 of IC7245 becomes "low". This will sink current from pin 32 of IC7225-6C. In this way IC7225-6C knows that a SECAM signal is present and will disable the IC7225-6C output.

## 9.12 Video controller IC7015-6D

RGB-de-matrixing de-matrixes the -(R-Y), -(B-Y) and the Y signals to RGB signals; the sandcastle pulse coming internally from IC7225-6E synchronises the RGB de-matrixing and suppresses the RGB signals during line and frame flyback.
Analogue controls by the $\mu$C for contrast (0-4V5), brightness (0-4V5) and saturation (0-4V5).
Fast blanking and RGB-source select; Via the BL_TXT_OSD signal on pin 21 of IC7225-6D both the fast blanking and the RGB source select is realised via the BL_ TXT_OSD fast blanking signal from the teletext + OSD part of the $\mu$C; this signal is "high" (> 1V) to switch the RGB source select switch into external mode to display teletext and OSD (via pins 22, 23 and 24 IC7225-6D).
BCI; If the beam current increases, the BCI-signal (Beam Current Info) decreases. If the beam current is too high, the CONTRAST control signal is pulled down to reduce the contrast (pin 25 of IC7225-6D).

## 9.13 AV input cinches (diagram A6)

AUDIO-IN is an incoming audio signal from the audio-in cinch. This signal goes to source select of IC7225-6F.
AUDIO-OUT is an outgoing audio signal from pin 1 of 7225-6F to the audio-out cinch.
VIDEO-IN becomes V-EXT and is the incoming CVBS-signal from the video-in cinch to the external input pin 15 IC7225-6B and the teletext processing.
VIDEO-OUT is coming from V-INT and is an outgoing CVBS-signal taken from after the sound trap (so after the IF detector IC7225-6A) which is fed to the video-out cinch.
The V-INT signal from the IF-detector is buffered by TS7150 before fed to the audio-out cinch .

## 9.14 CRT panel

RGB amplification by TS7300, TS7310 - TS7320, TS7330 - TS7340,TS7350 respectively
Cut off point adjustment for adjusting the R, G and B guns to start and stop emitting at the same correct level. Via R3350, R3310 and R3330 the DC level of the collectors TS7340, 7300 and 7320 and so the DC level of the guns are adjusted.
White D adjustment for adjusting the correct balance between R, G and B signal.

- Via R3340 and R3300 the amplitude of B and R signal can be adjusted to the amplitude of G
- Via TS7360 the R3340 and R3300 adjustment is de-coupled from influencing the G-amplification; the base DC-voltage of the RGB-amplifiers is equal to the black level of the RGB signals

Picture tube flash protection:

- Spark gaps in the PWB of the picture tube panel
- Resistors in series with the RGB electrodes 3355, 3215 and 3335 limiting the current through the guns
- Diodes 6354, 6314 and 6334 conduct at flash-over and so do not allow a higher voltage at the guns as approx. 160V

Peak beam current limiter; If the beam current is too high, the current though resp. R3352, 3312 and 3332 is high. The diodes 6350, 6310 and 6330 conduct and so TS7350, 7310 and 7330 can not supply more current to the guns and so the beam current is limited.

# Audio processing (diagram A6 and A8)

## 9.15 FM and AM demodulation

Two sound paths can be determined:

- For BG, I ,DK,M and N systems FM modulated inter-carrier sound (sound extracted from baseband CVBS from IF detector)
- For LL' systems AM modulated quasi- split sound (sound extracted directly from the tuner).

### *9.15.1 FM demodulation*

For FM modulated sound the sound signal is filtered through filter 1101 or 1102 from the baseband CVBS signal.
Input characteristic; By the switching signal CHROMA_1/I/BG/L/DK transistor 7102 can be switched on/off.

- In case CHROMA_1/I/BG/L/DK is "low", TS7102 does not conduct and filter L1102 is switched in parallel to L1101.
- In case CHROMA_1/I/BG/L/DK is "high", L1102 is not in parallel with L1101 any more. The frequency of the filters is mentioned on it.

FM-mono sound demodulation takes place in IC7225-6F. No adjustment is required for BG or I demodulation as automatic PLL tuning (4.2 to 6.8 MHz) is used. Pin 1 of IC7225-6F is used as:

- input for defining the sound frequency characteristic by de-emphasis C2101
- output for feeding the FM demodulated sound.

Source select between FM sound or AUDIO IN sound (pin 6 IC7225-6F) is done via pin 16 IC7225-6B (diagram A7).

### *9.15.2 AM demodulation*

AM-sound is for the moment not applicable. If in the future AM-sound becomes available this will be described.

## 9.16 Audio control and amplification

Bass and treble are directly controlled by the micro-controler. The bass signal is "low" for switching the bass amplification on. The treble signal is " low " for switching the treble amplification on. If bass amplification is "off" , 7124 is short-circuiting resistor 3124. If treble amplification is "off" resistor 3117 and capacitor 2117 are short-circuited by 7116.
Audio amplification is realised via the sound-amplifier 7120 or 7121 (depending on the version). The only difference is the output power.

# Control and teletext (diagram A5):

## 9.17 Teletext

In the L7 two microprocessors can be used; one with and one without teletext.

- In case of TXT, this teletext function is integrated together with the control part in one and the same $\mu$C. This $\mu$C is drawn in the diagrams with the outern pin numbering.
- In case of no TXT another $\mu$C is used with less pins. This $\mu$C is drawn in the diagrams with the internal pin numbering.

- Vertical S-correction; C2404 gives a parabolic voltage during the scan. A part of this voltage is integrated by R3418 and C2408 causing a superimposed "S-shaped" current over the deflection current which corrects the vertical linearity of the scan.
- For teletext non-interlaced mode (so 25 Hz frame) is required. For that a 25 Hz block-shaped NIL signal from the teletext decoder to the frame amplifier to ensure that odd & even frames coincide.

## Video processing (diagram A4, A7 and B1)

### 9.8 Tuning system

The tuner U1000 can be of a VST or a PLL type. In both cases the tuner is controlled by the $\mu$C:

- The VST tuner is controlled via V_TUNE, AFC and the BS1 and BS2 band switching signals.
- The PLL tuner is fully $I^2C$ controlled.

### 9.9 IF demodulation IC7225-6A

IC7225-6A contains the IF amplifier and the IF detector. The IF signal is present at the output pin 11 of the tuner.

*9.9.1 IF band pass filter*

The IF band pass characteristic is determined by the band pass of the SAW filter 1015:

- For PAL BG sets a SAW filter with 5.5 MHz bandwidth is used (33.4 to 38.9 MHz).
- For PAL I sets a SAW filter with a bandwidth of 6.0 MHz is used (32.9 to 38.9 MHz).
- For PAL BGI/SECAM BGLL' sets a SAW filter with 6.5 MHz bandwidth is used to enable BGILL' reception (33.9 to 40.4 MHz).
- For PAL BG/SECAM BGDK sets a SAW filter with a bandwidth of 6.5 MHz is used (32.4 to 38.9 MHz).
- IF-demodulator

After the band pass filter the IF signal is supplied to the IF-detector IC7225-6A pins 45 and 46. IF-demodulation is performed via the demodulation reference circuit 5260 on pins 2 and 3 IC7225-6A.
Delayed AGC control via the AGC voltage on pin 47 (AGC control is used for decreasing the amplification of the tuner-amplifiers in case the incoming signal on pin 45-46 IC7225-6A becomes too high (above the take-over level)). This take-over level can be adjusted on pin 49 by R3264.
AFC (Automatic Frequency Control) signal on pin 44 is obtained from the reference signal of the IF-detector.

### 9.10 IF source select, luminance-chrominance separation IC7225-6B

*9.10.1 Sound trap*

The baseband CVBS signal of pin 7 IC7225-6A (nominal amplitude of $2V_{pp}$) also contains the FM sound signal (FM intercarrier sound). This sound signal is filtered out with a ceramic filter (1206 resp. 1207) giving V-INT which is used for further video processing (IC7225 and IC7245), AV video out and teletext processing.

*9.10.2 Luminance-chrominance separation*

Chrominance signal is filtered (-20dB) by a luminance notch filter which is internally calibrated at the subcarrier frequency (4.43 or 3.58 MHz). CVBS information is also fed to the horizontal and vertical synchronisation seperator in IC7225-6E.

*9.10.3 CVBS source select*

The V-INT signal is fed to pin 13 IC7225-6B to the source selector switch in IC7225-6B. Pin 16 is used for source select control:

- Pin 16 = 0V gives internal CVBS mode, so V-INT from pin 13 IC7225-6B
- Pin 16 = 8V gives external CVBS mode, so V-EXT from pin 15 IC7225-6B (from the video-in cinch).
- Pin 16 is DC controlled via the INT/EXT signal from buffer TS7240 which is controlled by the AV-signal of the $\mu$C; so AV is "high" for internal CVBS and "low" for external CVBS.

*9.10.4 Sharpness control*

Sharpness control is realised via input pin 14 IC7225-6B (2V5-5V). Pin 14 is used as an input pin for sharpness control and an output pin for TRANS_ID (transmission identification).

- If IC7225-6E has horizontal synchronisation (video identification), pin 14 > 0V3 and by then is input pin for sharpness control by controlling the gain of the internal luminance signal. As pin 14 > 0V3 TS7269 does not conduct and TRANS_ID is "high" via pull-up resistor R3601 in the control part.
- If IC7225-6E has no horizontal synchronisation (no video identification), pin 14 is output pin < 0V3 so TS7269 conduct so TRANS_ID becomes "low"

### 9.11 Chrominance decoding IC7225-6C and IC7245

PAL and NTSC chrominance decoding is inside IC7225-6C and SECAM chrominance decoding is in IC7245. PAL or NTSC processing is determined automatically by the burst demodulator inside IC7225-6C. The reference crystals for demodulation for IC7225-6C are present at pin 34 and/or pin 35 of IC7225-6C.

- PAL/NTSC mode if voltage at pin 27 < 5V5; If IC7225-6C detects PAL, the voltage at pin 27 makes no sense. If IC7225-6C detects NTSC the voltage at pin 27 is used for hue control (0-5V). For NTSC sets jumper 9246 is added.
- For Tri-Norma sets the set selects (auto or forced) one of the three different crystals for PAL M, PAL N and NTSC M at pin 34 of IC7225-6C; For Tri-Norma sets pin 26 of IC7225-6D has a double function: Saturation control (normal input pin) or Tri-Norma system select (output pin) during system search.
- PAL/NTSC/SECAM mode if voltage at pin 27 of IC7225 is 5V5; IC7225-6C searches for PAL and IC7245 searches for SECAM. Via a bi-directional communication line between pin 32 of IC7225-6C and pin 1 of IC7245, both IC's know whether a PAL/NTSC or a SECAM signal is detected. The following signals are present on the communication line:

# Circuit description new circuitries

In the description below, the pin numbers mentioned are the numbers mentioned outside the housing of IC7601, so for the $\mu$C with integrated TXT functionality. In case of the $\mu$C with integrated teletext function, the CVBS-signal is fed to pin 23 or 24 depending on the fact if it is the internal or external CVBS-signal (V_INT or V_EXT). In this way teletext can be used both on the internal or the external signal. The TXT and OSD-information is combined at pins 32-33-34.

## 9.18 Control

Following description explains the functionality of the $\mu$C pins anti-clockwise for the outern pinning numbers.

- Control-voltage outputs (pin 1-7 and pin 9-10); These pins are PWM (Pulse Width Modulated) output pins used for volume, contrast, saturation, hue, brightness, sharpness, bass and treble and tuning control (only for VST).
  - ⇒ The V-TUNE varies between 0-30V and is derived from the +95V supply from the power supply.
  - ⇒ The saturation pin 4 has two functions; output pin for saturation control and input pin for auto system search in case of Bi- and tri-norma sets (-/77 sets).
  - ⇒ Bass and treble functionality is only used in case of sets with the "smart sound" feature.
- AV (pin 8); Output switching signal "high" for internal CVBS-mode and "low" for external mode (AV-mode, so cinch mode).
- AFC (pin 11); Input pin for AFC-control.
- AV_MUTE (pin 12); Output switching signal used for muting the audio output cinch. This signal is "high" in case of mute.
- Functional switch (pin 15); For USA ,sets do not have a mains switch but a functional switch. If pin 15 is connected to ground by means of 1064, the set is switched to stand-by.
- Protection (pin 16); This pin is an input pin for protections. If this pin is connected to ground, the set is switched in protection. By this protection the voltages +9V and HEW are monitored to check if they become to high. If the +9V drops, this is monitored by the circuit arround 7608. The emitter becomes "low" (0V7 lower than the base voltage) if the +9V drops. This will force pin 16 of the $\mu$C "low" and will switch the set in protection.
- BS1 and BS2 (pin 17-18); Switching signals used for band switching of a VST tuner.

| | BS1 | BS2 |
|---|---|---|
| VHF1 | 0 | 1 |
| VHF2 | 1 | 0 |
| UHF | 1 | 1 |

- STANDBY (pin 19);Output pin "high" for normal operation and "low" for standby.
- LED-drive (pin 20); Signal to drive the LED
  - ⇒ In standby, the LED lights continuously by pulling pin 20 "low"
  - ⇒ In normal operation the LED does not light by not pulling pin 20 "low"
  - ⇒ During RC5 reception pin 20 is pulled "low" time by time, resulting in a pulsing LED
- Ground (pin 21); Ground of the power-supply.
- Test pin (pin 22); Used for test purposes in the factory
- CVBS-inputs (pin 23-24); These pins are used as input for teletext-sources. Pin 24 is used as input for the external CVBS-signal (VIDEO-IN input cinch) and pin 23 for the internal CVBS-signal of the set.
- NIL (pin 27); Signal to generate a DC-current through the deflection coil to create a non interlaced mode during TXT-mode.
- TXT/OSD-signals (pin 32-33-34); These output pins are used to create TXT and OSD information in different colours.
- BL-TXT-OSD (pin 35); Output signal (BL_TXT_OSD) used to indicate the video controller that there is OSD or Teletext information. So this signal blanks the video information.
- SANDCASTLE (pin 36); Pin to inform the $\mu$C that horizontal flyback takes place. This information is needed to place the TXT and OSD correctly on the picture.
- VFL (pin 37); This pin is used to tell the $\mu$C that vertical flyback takes place. This information is needed to place the TXT and OSD correctly on the picture.
- OSD-generator (pin 38-39-40); The components connected these pins determine the frequency of the OSD-generator. This is approx. 8 MHz.
  - ⇒ In a non TXT set, the OSD generator is formed by C2680, C2681, L5680 and L5681 (4682 and 4683 are not mounted).
  - ⇒ In a TXT set, C2680, C2681 and L5680 are not present but 4682 and 4683 are mounted.
- 12 MHz oscillator (pin 41-42); The frequency of the oscillator of the $\mu$C is determined by this crystal 5600.
- POR (pin 43) ; At switching on the set with the mains switch the signal at pin 43 becomes "high" and holds the $\mu$C. The $\mu$C waits until the signal at pin 43 becomes "low". In this way the $\mu$C knows that the supply-voltage is high enough to be able to perform well.
- TXT / no TXT (pin 44); In case jumper 4602 is present, the software "knows" as a no-TXT set (PCF84C44). In case jumper 4602 is not present, the software "knows" as a TXT set (SAA5290).
- IR-input (pin 45); Input for the remote-control commands
- Video system selections (pin 46-47-48); These three outputs can be used in different ways depending on the region where the set is produced for:
  - ⇒ For Asian Pacific sets the CHROMA1_I/BG/L/DK signal is used for sound crystal selection in the FM sound demodulation part . In case I/BG/L/DK signal is "low" L1102 is switched in parralel to L1101.
  - ⇒ For Latin America a so called Bi-Norma (PAL-M and NTSC-M) or Tri-Norma (PAL M/N and NTSC M) is configured by using the CHROMA_0, CHROMA_1 and CHROMA_2 switching signals. For these Bi- and Tri-Norma sets the SATURATION output pin 4 is also used as an input pin for the Tri-Norma automatic system selection.

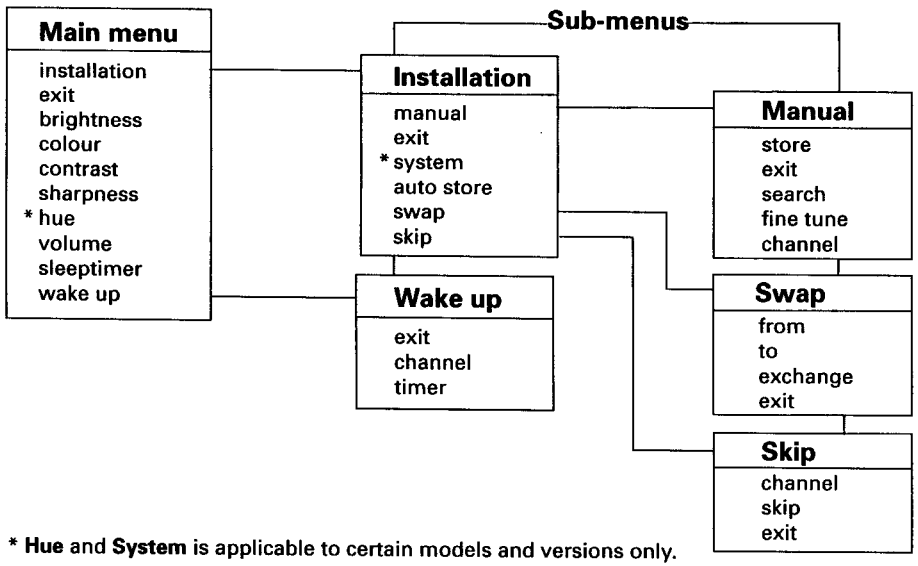
| | CHROMA_0 | CHROMA_1 | CHROMA_2 |
|---|---|---|---|
| PAL M | 0 | 1 | |
| PAL N | 1 | 0 | |
| NTSC M | 1 | 1 | |

- $I^2C$-Bus (pin 49-50); This bus is used to communicate with all used $I^2C$ devices.
  - ⇒ Non Volatile Memory (EEPROM) in which the settings are stored. In case pin 1 of this NVM is shorted while switching on the set with the mains switch, the SDAM (Service Default Alignment Mode); see chapter 6.
  - ⇒ In case of a PLL tuner, the $I^2C$-Bus is used via the copper tracks of BS1 and BS2 (these copper tracks are used for band switching in a VST set).
- VIDEO_ID (video identification; pin 51); Pin 51 is "high" in case a video signal is detected and "low" in case no video signal is detected. This signal is coming from pin 14 IC7225-6B.
- Supply voltage (pin 52); If this voltage is present and the Power On Reset (POR) signal at pin 43 is "low" the $\mu$C will start.

# Installation

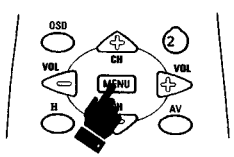
**Operating instructions generally explains the operation of the TV set using the buttons on the remote control handset unless otherwise stated.**

## Overview of main menu and sub-menus

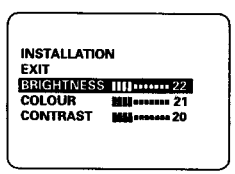


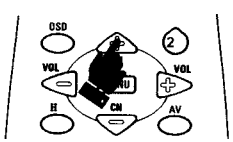

* **Hue** and **System** is applicable to certain models and versions only.

## How to start Automatic Installation (Auto Store)

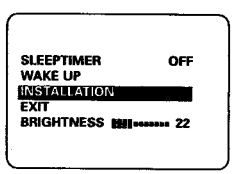


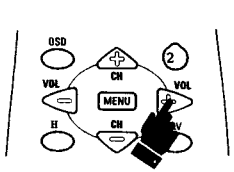
1. Press **MENU** button to enter main menu.



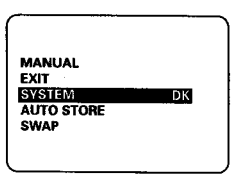



2. Press **CH** ⌃ button repeatedly until **INSTALLATION** is highlighted.



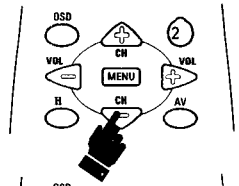
3. Press **VOL** ⌃ button to enter installation mode.



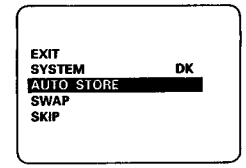


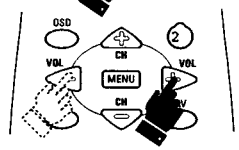



# Installation

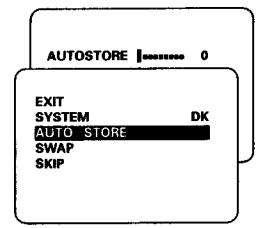


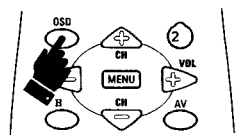
4. Press **CH** ⌃ button to highlight **AUTO STORE**.



5. Press **VOL** ⌃ or ⌃ button to start automatic tuning.
**NOTE** : If you want to terminate automatic tuning while tuning is in progress, press the **OSD** button.
**NOTE** : If you start searching and storing when you are in Channel number N(eg. 20), the programmes found will start storing from Channel N + 1 (eg. 21) onwards.
**NOTE** : Searching and storing stops at the last channel (Channel 79).



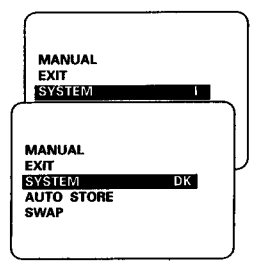



6. Once automatic tuning is completed, press **OSD** button to exit from menu.
*** To get back to main menu , you need to select "EXIT" on the sub-menu and press VOL ⌃ or ⌃ button to exit. If necessary, repeat the above procedure until main menu appears.**

**NOTE**

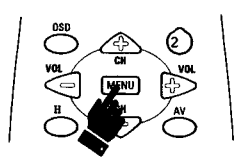
**(Applicable to certain models/versions only)**

- If you hear any **"noisy"** sound on any channel after automatic tuning is completed, repeat **step 1** to **3**.
- Press **VOL** ⌃ or ⌃ button to select **PAL I** or **PAL DK**.
- Press **OSD** button to exit from menu.

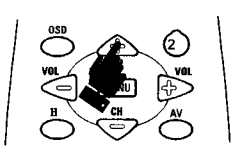



## How to start Manual Installation

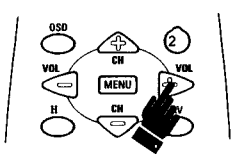
You can also do installation manually by the **SEARCH** method. Manual installation allows you to select your preferred channel number for every available station



1. Enter main menu.

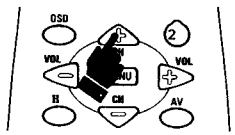


2. Highlight **INSTALLATION** .

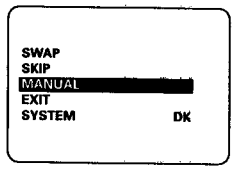


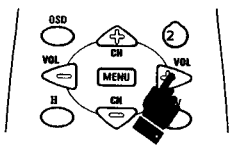
3. Enter installation mode.

## Installation

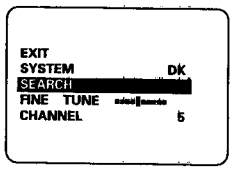


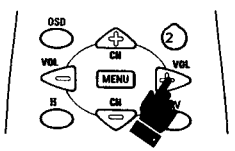
4 Press **CH** ⌃ button repeatedly until **MANUAL** is highlighted.



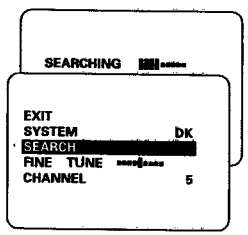



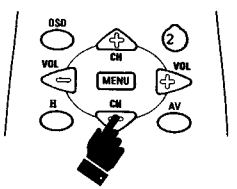
5. Press **VOL** ⌃ button to enter manual mode.



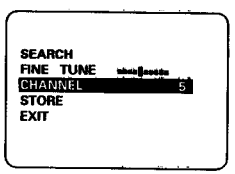



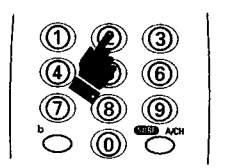
6. Press **VOL** ⌃ button to activate **SEARCHING** mode. Searching stops once a station is available. If you decide to store the available station, proceed to the next step. However, if you decide to continue searching for another station, press **VOL** ⌃ button again until another station is found.



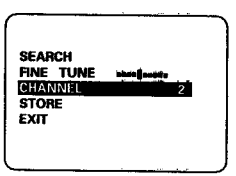



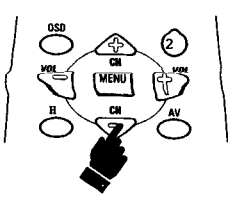
7. Press **CH** ⌄ button repeatedly until **CHANNEL** is highlighted.



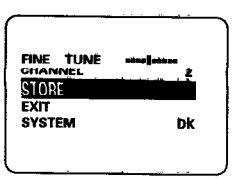



8. Key in desired channel number by the **DIGIT (0 - 9)** button.



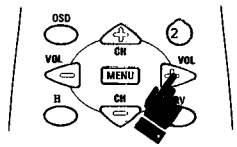



9. Press **CH** ⌄ button to highlight **STORE** .

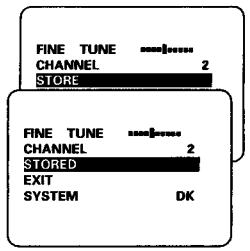


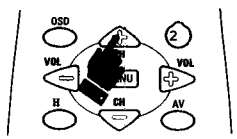



## Installation / Swap feature

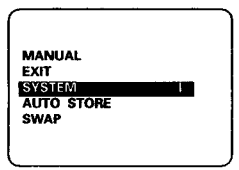


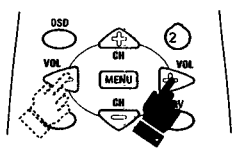
10. Press **VOL** ⌃ button to store the channel.



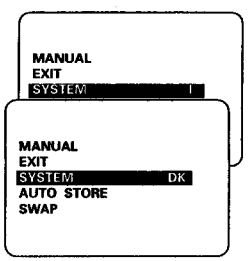



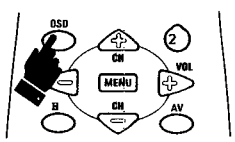
11. If you hear any **"noisy"** sound after manual installation is completed, press **CH** ⌃ button to highlight **SYSTEM**. **(Applicable to certain models and versions only).**



12. Press **VOL** ⌄ or ⌃ button to select **PAL I** or **PAL DK**. **(Applicable to certain models and versions only).**

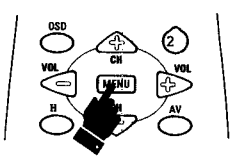


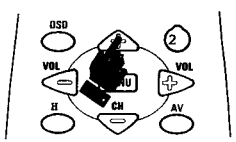
13. Press **OSD** button to exit from menu.

### How to Swap Channels

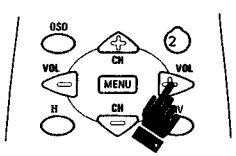
This feature allows you to change the channel number to your choice for a particular TV station.



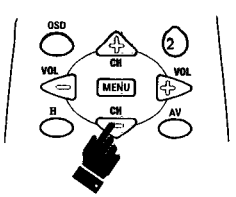
1. Enter main menu.



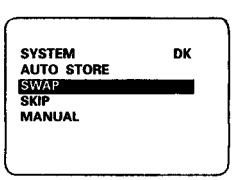
2. Highlight **INSTALLATION** .



3. Enter installation mode.



4. Press **CH** ⌄ button repeatedly until **SWAP** is highlighted.



# 11. List of abbreviations (incl. all signal names)

| | |
|---|---|
| +160V | +16V supply voltage from the LOT to the picture tube panel |
| +95V | +95V supply voltage from the SOPS to the line output stage and the tuning circuit |
| +26V | +26V supply voltage from the LOT to the frame amplifier IC7401 |
| +10V/14V | +xxV supply voltage from the SOPS to supply the audio amplifier |
| +10V | +10V supply voltage from the SOPS to the line drive stage (A3) |
| +9V | +9V supply voltage from the LOT to the relais of the degaussing coil and to the supply voltages +8V and +8VI |
| +8V/+8VI | +8V supply voltage from the LOT to supply IC7225 |
| +5V5 | +5V5 supply voltage from the LOT for the tuner and to create VB for bandswitching |
| +5V | +5V supply voltage from the SOPS to supply the control part |
| µC | Microcomputer |
| AFC | Automatic Frequency Control |
| AGC | Automatic Gain Control |
| AUDIO_IN | AUDIO-IN signal from audio cinch; this signal is fed to IC7015-6F for source select |
| AV | Switching signal from the µC to select between internal and external video/audio |
| AV-MUTE | Signal to mute the sound on the Audio-out cinch |
| AQUA | Aquadag on the rear side of the picture tube to pin 8 of the LOT |
| AUDIO_OUT | Outgoing audio signal from pin 1 of IC7225-F to audio_out cinch |
| B_TXT_OSD | Blue input signal from the µC to the video controller IC7015-6D |
| BS1 | Switching signal from µC for band switching to tuner 1000 |
| BS2 | Switching signal from µC for band switching to tuner 1000 |
| BCI | Beam Current Info; If beam current increases the BCI signal decreases. BCI is used for contrast reduction (if beam current is too high) |
| BL-TXT-OSD | Fast blanking signal to IC7225-6D to display OSD and TXT |
| BRIGHTNESS | Control signal (from µC, but on DC level via RC network) for brightness control of the video controller IC7015-6D (0-5V) |
| CHROMA | Chrominance part of the video signal |
| CHROMA-0_L/L'/I | Signal to select the correct system in case of trinorma |
| CHROMA-1_I/BG/L/DK | Signal from the µC to select the correct sound x-tal. In case of trinorma to select the correct system |
| CHROMA-2/STATUS | Signal to select the correct system in case of trinorma |
| CONTRAST | Control signal (from µC, but on DC level via RC network) for contrast control of the video controller IC7015-6D |
| CVBS | Colour Video Blanking Synchronisation |
| V-EXT | Incoming CVBS signal from cinch video_in to the external input pin 15 IC7015-6B |
| V-INT | Outgoing CVBS signal from sound trap on pin 7 IC7015-6A (IF detector) to the video_out cinch |
| EEPROM | Electrical Erasable Programmable Read Only Memory |
| ESD | Electrical Static Discharge |
| ff | Filament (heater voltage) from LOT to the picture tube |
| FM | FM demodulated sound from the FM-demodulator IC7015-6F to smart sound |
| G-TXT-OSD | Fast blanking signal to IC7225-6D to display OSD and TXT |
| HUE | Signal from the µC to control the hue of the video signal |
| HEW | X-ray detection. If this signal is too high, X-ray could occure so the set is switched in protection |
| HOR. FLYBACK | Horizontal flyback pulse (15625 Hz) used for locking the horizontal oscillator in IC7015-6E |
| $I^2C$ | Digital control bus of the microcomputer |
| VIDEO-ID | Status signal from IC7015-6B; "low" for no CVBS signal (horizontal sync not present), "high" in case CVBS signal is present (horizontal sync present) from the IF-detector IC7015-6B to the µC |
| IF | Intermediate frequency signal from the tuner |
| NIL | Non Inter Lace; 25 Hz block-shaped signal from teletext to the frame amplifier for coinciding the odd & even frames |
| POR | Power On Reset; ensures the µC starts up its software only if the power supply of the µC itself is high enough |
| PP | Personal Preference |
| PROT | Protection signal from frame IC7401; in case the vertical flyback generator in IC7401 is not activated, the voltage on pin 8 IC7401 becomes < 2V. By then the protection circuit in IC7401 will make pin 7 "high" overriding the HOR FLYBACK and SANDCASTLE. The constant "high" sandcastle will cause the picture to become "black" |
| R_TXT_OSD | Fast blanking signal to IC7225-6D to display OSD and TXT |
| RAM | Random Access Memory |
| ROM | Read Only Memory |
| SANDCASTLE | Sandcastle signal from IC7015-6F to delay line IC7255 and SECAM chrominance decoder IC7245 |
| SATURATION | Control signal (from µC, but on DC level via RC network) for saturation control of the video controller IC7015-6D (0-2V5) |
| SAW | Surface Acoustic Wave; high precision band pass filter |
| SCL | Clock line of the $I^2C$-bus |
| SDA | Data line of the $I^2C$-bus |
| SAM | Service Alignment Mode; Service mode for doing alignments. |
| SDM | Service Default Mode; predefined mode for faultfinding (see chapter 8) |
| SDAM | Service Default Alignment Mode; Combined mode of SAM and SDM. |
| SHARPNESS CONTROL | Control signal on DC level (0-5V) from µC to IF-detector IC7015-6B) for sharpness control |

# List of abbreviations (incl. all signal names)

| | |
|---|---|
| SMART SOUND | Bass and treble countrol before the sound amplifier. |
| STANDBY | Switching signal from $\mu$C; "low" for standby (power supply will be switched to stand-by mode), "high" for normal operation |
| INT/EXT | Switching signal derived from the AV-signal for internal or external audio + video switching ("low" for internal and "high" for external) |
| VT | Tuning voltage from which the signal TUNING VOLTAGE is derived to tune the tuner |
| VERT DRIVE | Vertical drive signal from IC7225-6E to frame amplifier IC7401 |
| VFB | 50 Hz vertical flyback pulse used for locking the vertical oscillator in IC7225-6E |
| VFL | 50 Hz vertical flyback pulse used to inform the $\mu$C that flyback takes place. This is important for OSD and TXT. |
| Vg2 | Voltage on grid 2 of the picture tube |
| VOLUME | Control signal (from $\mu$C, but on DC level via RC network) for volume control of sound processing in IC7225-6F |
| Y | Luminance part of the video signal |

# 12. Spare parts list

## Main carrier [A]

### Various

| | | |
|---|---|---|
| | 4822 492 70788 | SPRING |
| | 4822 265 20689 | CONN. 2-P MALE |
| ▲ | 4822 492 70289 | SPRING |
| ▲ | 4822 265 20439 | CONNECTOR 2-P |
| ▲ | 4822 276 13603 | SWITCH,MAINS |
| ▲ | 4822 256 92053 | PLASTICHOLDER |
| ▲ | 4822 265 20723 | CONNECTOR 2-P |
| | 4822 256 10336 | LED HOLDER |
| | 4822 157 11166 | EMI FILT. 40MHz |
| | 4822 267 10538 | CONN.3-P MALE |
| | 4822 267 31014 | PHONE CONN. |
| | 4822 267 10549 | CONN.4-P FEM |
| | 4822 265 10481 | CINCH CONN 2-P |
| | 4822 441 11878 | CINCH HOUSING |
| ▲ | 4822 276 13603 | MAIN SWITCH |
| ▲ | 4822 256 92053 | FUSE HOLDER |
| | 4822 157 11166 | EMI FILT.40MHZ |
| | 4822 267 10538 | CONN. 3-P MALE |
| 1000 | 4822 210 10737 | TUNER UV1355/I |
| 1015 | 4822 242 72197 | FILTER 38MHz |
| 1015 | 4822 242 73792 | FILTER 45MHz |
| 1060 | 4822 276 13775 | SWITCH |
| 1061 | 4822 276 13775 | SWITCH |
| 1062 | 4822 276 13775 | SWITCH |
| 1063 | 4822 276 13775 | SWITCH |
| 1101▲ | 4822 242 10316 | FILTER 6,5MHz |
| 1102 | 4822 242 10314 | FILTER 5,5MHz |
| 1102 | 4822 242 10362 | FILTER 6,0MHz |
| 1102 | 4822 242 10363 | FILTER 4,5MHz |
| 1206 | 4822 242 81572 | FILTER 6,0MHz |
| 1206 | 4822 242 81712 | FILTER 5,5MHz |
| 1206 | 4822 242 81978 | FILTER 4,5MHz |
| 1207 | 4822 242 81301 | FILTER 6,5MHz |
| 1275 | 4822 242 10356 | X-TAL 4,433MHz |
| 1277 | 4822 242 10355 | X-TAL 3,579MHz |
| 1449▲ | 4822 071 54001 | FUSE 400mA |
| 1500 | 4822 070 34002 | FUSE 4A |
| 1571▲ | 4822 071 51602 | FUSE 1.6A |
| 1572▲ | 4822 071 53151 | FUSE 315mA |
| 1670 | 4822 218 11573 | IR RECEIVER |
| 1681 | 4822 242 10694 | X-TAL 12MHz |
| 1681 | 5322 242 73686 | FILTER 12MHz |

### ⊣⊢

| | | |
|---|---|---|
| 2008 | 4822 126 13296 | 100nF 10% 16V |
| 2008▲ | 5322 122 34123 | 1nF 10% 50V |
| 2010 | 4822 124 11582 | 2200µF 20% 16V |
| 2011 | 5322 122 32452 | 47pF 5% 63V |
| 2013 | 5322 122 32452 | 47pF 5% 63V |
| 2016▲ | 4822 124 40433 | 47µF 20% 25V |
| 2101▲ | 5322 126 10223 | 4.7nF 10% 63V |
| 2101 | 5322 126 10465 | 3.9nF 10% 63V |
| 2102 | 4822 121 43897 | 1nF 5% 400V |
| 2102 | 4822 126 13498 | 82pF 5% 50V |
| 2102 | 4822 126 13644 | 47pF 5% 63V |
| 2103 | 4822 126 13061 | 220nF 20% 25V |
| 2104 | 4822 124 40248 | 10µF 20% 63V |
| 2105 | 4822 124 81108 | 0.47µF 20% 50V |
| 2106▲ | 4822 122 33342 | 33nF 10% 63V |
| 2107▲ | 5322 126 10223 | 4.7nF 10% 63V |
| 2108 | 4822 122 33515 | 82pF 5% 63V |
| 2108 | 4822 126 13693 | 56pF 1% 63V |
| 2108 | 5322 122 32452 | 47pF 5% 63V |
| 2109 | 4822 124 41576 | 2.2µF 20% 50V |
| 2110▲ | 4822 126 13838 | 100nF 20% 50V |
| 2111 | 4822 124 81028 | 220µF 20% 25V |
| 2116 | 4822 121 51379 | 82nF 5% 63V |
| 2117▲ | 5322 122 32654 | 22nF 10% 63V |
| 2120 | 4822 121 42868 | 220nF 5% 50V |
| 2121 | 4822 126 13061 | 220nF 20% 25V |
| 2122 | 5322 126 10511 | 1nF 5% 50V |
| 2124 | 5322 121 42386 | 100nF 5% 63V |
| 2130 | 4822 124 11566 | 47µF 20% 50V |
| 2135 | 4822 124 81033 | 100µF 20% 50V |
| 2136 | 4822 124 81033 | 100µF 20% 50V |
| 2138▲ | 4822 121 43823 | 470nF 5% 50V |
| 2150 | 4822 124 81022 | 1µF 20% 50V |
| 2152 | 4822 124 41576 | 2.2µF 20% 50V |
| 2190 | 4822 126 13512 | 330pF 10% 50V |
| 2208 | 4822 126 13751 | 47nF 10% 63V |
| 2212 | 5322 121 42386 | 100nF 5% 63V |
| 2213 | 4822 126 13561 | 220nF 10% 16V |
| 2221▲ | 4822 126 13838 | 100nF 20% 50V |
| 2222 | 4822 124 41576 | 2.2µF 20% 50V |
| 2224 | 4822 124 41584 | 100µF 20% 10V |
| 2228 | 4822 126 13296 | 100nF 10% 16V |
| 2231▲ | 5322 122 32654 | 22nF 10% 63V |
| 2243▲ | 5322 122 32654 | 22nF 10% 63V |
| 2245▲ | 4822 126 13838 | 100nF 20% 50V |
| 2246 | 4822 126 13628 | 220N 20% 50V |
| 2248▲ | 5322 122 34123 | 1nF 10% 50V |
| 2249▲ | 5322 122 34123 | 1nF 10% 50V |
| 2251▲ | 5322 122 32654 | 22nF 10% 63V |
| 2254 | 4822 124 81164 | 22U 20% 25V |
| 2256▲ | 4822 126 13838 | 100nF 20% 50V |
| 2257▲ | 4822 126 13838 | 100nF 20% 50V |
| 2260 | 4822 126 13689 | 18pF 1% 63V |
| 2260 | 5322 122 33869 | 15pF 5% 63V |
| 2261▲ | 5322 122 32654 | 22nF 10% 63V |
| 2264▲ | 5322 122 32654 | 22nF 10% 63V |
| 2265 | 4822 124 41576 | 2.2µF 20% 50V |
| 2265 | 4822 124 81108 | 0.47µF 20% 50V |
| 2270 | 4822 126 13296 | 100nF 10% 16V |
| 2271 | 4822 126 13296 | 100nF 10% 16V |
| 2272 | 5322 122 33446 | 3.3nF 10% 63V |
| 2273 | 4822 126 13296 | 100nF 10% 16V |
| 2275 | 5322 122 33869 | 15pF 5% 63V |
| 2277 | 5322 122 33869 | 15pF 5% 63V |
| 2280 | 4822 126 13751 | 47nF 10% 63V |
| 2284 | 4822 126 13751 | 47nF 10% 63V |
| 2285 | 4822 126 13751 | 47nF 10% 63V |
| 2290▲ | 4822 126 13838 | 100nF 20% 50V |
| 2291 | 4822 124 40849 | 330µF 20% 16V |
| 2299 | 4822 122 40606 | 22nF 20% 50V |
| 2301 | 5322 121 42386 | 100nF 5% 63V |
| 2304 | 4822 126 10334 | 470pF 10% 50V |
| 2324 | 4822 122 33528 | 390pF 5% 50V |
| 2324 | 5322 122 32336 | 560pF 10% 100V |
| 2344 | 4822 126 10334 | 470pF 10% 50V |
| 2370 250V | 4822 121 41689 | 100nF 10% |
| 2373 | 4822 121 41926 | 33nF 5% 630V |
| 2400 | 4822 122 33127 | 2.2nF 10% 63V |
| 2401 | 4822 122 32646 | 5.6nF 10% 50V |
| 2402 | 4822 122 33528 | 390pF 5% 50V |
| 2403 | 4822 124 41596 | 22µF 20% 50V |
| 2403 | 4822 124 81033 | 100µF 20% 50V |
| 2404 | 4822 124 40248 | 10µF 20% 63V |
| 2404 | 4822 124 41596 | 22µF 20% 50V |
| 2406 | 4822 121 43901 | 4.7nF 5% 50V |
| 2407 | 4822 121 51399 | 47nF 10% 50V |
| 2407 | 5322 121 42386 | 100nF 5% 63V |
| 2408 | 4822 124 11582 | 2200µF 20% 16V |
| 2408 | 4822 124 81039 | 3300µF 20% 25V |
| 2421 | 4822 122 32627 | 2.7nF 10% 50V |
| 2422 | 4822 124 81022 | 1µF 20% 50V |
| 2423▲ | 5322 126 10223 | 4.7nF 10% 63V |
| 2424▲ | 4822 126 13838 | 100nF 20% 50V |
| 2425 | 4822 124 81164 | 22U 20% 25V |
| 2426 | 5322 121 42386 | 100nF 5% 63V |
| 2427▲ | 5322 126 10223 | 4.7nF 10% 63V |
| 2440 | 4822 121 43925 | 2.2nF 5% 50V |
| 2442 | 4822 126 13628 | 220N 20% 50V |
| 2443 | 4822 124 40198 | 470µF 20% 16V |
| 2444 | 4822 121 51319 | 1µF 10% 63V |
| 2445▲ | 4822 121 70618 | 12nF 5% 1600V |
| 2445 | 4822 121 70649 | 9.1nF 5% 1.6KV |
| 2448 | 4822 121 43368 | 47µF 20% 160V |
| 2450 | 4822 121 10506 | 560N 5% 250V |
| 2450 | 4822 121 10507 | 470N 5% 250V |
| 2451 | 4822 121 51319 | 1µF 10% 63V |
| 2452 | 4822 124 81165 | 470U 20% 10V |
| 2453 | 4822 124 11771 | 1000µF 20% 35V |
| 2460 | 4822 121 43245 | 68nF 10% 100V |
| 2460 | 4822 121 43378 | 82nF 10% 100V |
| 2461 | 4822 126 13645 | 27pF 5% 50V |
| 2462 | 4822 126 11824 | 100pF 10% 1KV |
| 2470▲ | 4822 124 11508 | 22uF 20% 250V |
| 2471 | 4822 121 41856 | 22nF 5% 250V |
| 2500▲ | 4822 126 13589 | 470N 20% 275V |
| 2501 | 4822 121 70141 | 33nF 5% 400V |
| 2502 | 4822 126 12793 | 2.2nF 10% 2KV |
| 2504 | 4822 126 12793 | 2.2nF 10% 2KV |
| 2505 | 4822 126 12793 | 2.2nF 10% 2KV |
| 2508 | 4822 124 11907 | 100µF 20% 400V |
| 2508 | 4822 124 41748 | 220µF 20% 400V |
| 2509▲ | 4822 122 50116 | 470pF 10% 1KV |
| 2510▲ | 4822 122 50116 | 470pF 10% 1KV |
| 2517▲ | 5322 122 34123 | 1nF 10% 50V |
| 2518▲ | 4822 126 12426 | 330pF 10% 1KV |
| 2520 | 4822 122 33515 | 82pF 5% 63V |
| 2521 | 4822 122 33127 | 2.2nF 10% 63V |
| 2522 | 4822 122 33127 | 2.2nF 10% 63V |
| 2529▲ | 4822 126 13838 | 100nF 20% 50V |
| 2530 | 4822 124 81022 | 1µF 20% 50V |
| 2531 | 4822 121 10646 | 560pF 1% 400V |
| 2533 | 5322 122 31863 | 330pF 5% 50V |
| 2534 | 5322 126 10511 | 1nF 5% 50V |
| 2537 | 5322 121 42386 | 100nF 5% 63V |
| 2540 | 4822 124 81029 | 100µF 20% 25V |
| 2541 | 4822 121 43872 | 3.3nF 5% 50V |
| 2545▲ | 4822 126 14049 | 1.5nF 20% 250V |
| 2550▲ | 4822 126 12426 | 330pF 10% 1KV |
| 2551 | 4822 124 42336 | 47µF 20% 160V |
| 2552 | 4822 126 13597 | 330pF 10% 500V |
| 2561 | 4822 124 40198 | 470µF 20% 16V |
| 2563 | 4822 124 41596 | 22µF 20% 50V |
| 2571 | 4822 124 11908 | 2200µF 20% 25V |
| 2572 | 5322 122 32531 | 100pF 5% 50V |
| 2602▲ | 4822 124 40433 | 47µF 20% 25V |
| 2610 | 4822 126 13628 | 220N 20% 50V |
| 2611 | 4822 124 40248 | 10µF 20% 63V |
| 2615 | 4822 126 13628 | 220N 20% 50V |
| 2620 | 5322 126 10184 | 680P 5% 50V. |
| 2621 | 4822 122 33515 | 82pF 5% 63V |
| 2622 | 4822 122 33515 | 82pF 5% 63V |
| 2623▲ | 5322 122 32654 | 22nF 10% 63V |
| 2630 | 4822 124 40248 | 10µF 20% 63V |
| 2631 | 4822 124 40248 | 10µF 20% 63V |
| 2632 | 4822 124 40248 | 10µF 20% 63V |
| 2633 | 4822 124 40248 | 10µF 20% 63V |
| 2634 | 4822 124 81022 | 1µF 20% 50V |
| 2635▲ | 4822 124 40433 | 47µF 20% 25V |
| 2639▲ | 4822 126 13838 | 100nF 20% 50V |
| 2650 | 5322 126 10184 | 680P 5% 50V. |
| 2652 | 5322 126 10184 | 680P 5% 50V. |
| 2653 | 5322 122 34098 | 10nF 10% 63V |
| 2662 | 5322 126 10184 | 680P 5% 50V. |
| 2664▲ | 4822 126 13838 | 100nF 20% 50V |
| 2665▲ | 4822 126 13838 | 100nF 20% 50V |
| 2666▲ | 4822 126 13838 | 100nF 20% 50V |
| 2670 | 5322 122 32531 | 100pF 5% 50V |
| 2671 | 4822 124 81029 | 100µF 20% 25V |
| 2674 | 5322 122 32531 | 100pF 5% 50V |
| 2680 | 4822 126 13689 | 18pF 1% 63V |
| 2681 | 4822 126 13689 | 18pF 1% 63V |
| 2682 | 5322 122 31946 | 27pF 5% 63V |
| 2683 | 5322 122 31946 | 27pF 5% 63V |
| 2687 | 4822 122 33575 | 220pF 5% 50V |
| 2690 | 4822 122 33575 | 220pF 5% 50V |
| 2691 | 5322 122 32531 | 100pF 5% 50V |
| 2692 | 5322 122 32531 | 100pF 5% 50V |
| 2693 | 5322 122 32531 | 100pF 5% 50V |
| 2694▲ | 4822 126 13838 | 100nF 20% 50V |

### ⊣□⊢

| | | |
|---|---|---|
| 3000 | 4822 050 11002 | 1k 1% 0.4W |
| 3004 | 4822 050 11002 | 1K 1% 0.4W |
| 3005 | 4822 050 11002 | 1k 1% 0.4W |
| 3006 | 4822 050 11002 | 1k 1% 0.4W |
| 3007▲ | 4822 051 20102 | 1k 1% 0.4W |
| 3008 | 4822 050 11002 | 1k 1% 0.4W |
| 3009 | 4822 050 11002 | 1K 1% 0.4W |
| 3010▲ | 4822 052 10478 | 4Ω7 5% 0.33W |
| 3011 | 4822 051 20822 | 8k2 1% 0.4W |
| 3101 | 4822 051 20394 | 390k 5% 0.1W |
| 3102 | 4822 050 13902 | 3k9 1% 0.4W |
| 3104 | 4822 117 11449 | 2k2 1% 0.1W |
| 3105 | 4822 051 20223 | 22k 5% 0.1W |
| 3106▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3107▲ | 4822 051 20472 | 4k7 5% 0.1W |
| 3108 | 4822 116 83868 | 150Ω 5% 0.5W |
| 3109 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3110 | 4822 117 11503 | 220Ω 1% 0.1W |
| 3111▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3112 | 4822 050 15603 | 56k 1% 0.4W |
| 3113 | 4822 050 11002 | 1k 1% 0.4W |
| 3116▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3117 | 4822 051 20471 | 470Ω 5% 0.1W |
| 3119 | 4822 116 52283 | 4k7 5% 0.5W |
| 3120 | 4822 051 20224 | 220k 5% 0.1W |
| 3121 | 4822 117 11507 | 6k8 1% 0.1W |
| 3122 | 4822 051 20182 | 1k8 5% 0.1W |
| 3123 | 4822 051 20182 | 1k8 5% 0.1W |
| 3124 | 4822 051 20474 | 470k 5% 0.1W |
| 3125 | 4822 051 20223 | 22k 5% 0.1W |
| 3129▲ | 4822 051 20332 | 3k3 5% 0.1W |
| 3135 | 4822 116 52228 | 680Ω 5% 0.5W |
| 3136 | 4822 116 52228 | 680Ω 5% 0.5W |
| 3138▲ | 4822 051 20153 | 15k 5% 0.1W |
| 3142 | 4822 117 11504 | 270Ω 1% 0.1W |
| 3144▲ | 4822 051 20229 | 22Ω 5% 0.1W |
| 3145 | 4822 050 13302 | 3k3 1% 0.4W |
| 3150 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3153 | 4822 116 83961 | 6k8 5% |
| 3155 | 4822 116 52228 | 680Ω 5% 0.5W |
| 3157▲ | 4822 051 20472 | 4k7 5% 0.1W |
| 3158▲ | 4822 051 20153 | 15k 5% 0.1W |
| 3170 | 4822 051 20471 | 470Ω 5% 0.1W |
| 3188▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3200 | 4822 050 11503 | 15k 1% 0.4W |
| 3201 | 4822 050 11002 | 1k 1% 0.4W |
| 3202▲ | 4822 051 20153 | 15k 5% 0.1W |
| 3203 | 4822 117 11449 | 2k2 1% 0.1W |
| 3206 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3206 | 4822 117 11448 | 180Ω 1% 0.1W |
| 3207 | 4822 050 13302 | 3k3 1% 0.4W |
| 3208▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3208 | 4822 117 11454 | 820Ω 1% 0.1W |
| 3210 | 4822 051 20104 | 100k 5% 0.1W |
| 3211 | 4822 051 20331 | 330Ω 5% 0.1W |
| 3212▲ | 4822 051 20472 | 4k7 5% 0.1W |
| 3213 | 4822 051 20104 | 100k 5% 0.1W |
| 3214▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3219 | 4822 051 20275 | 2M7 5% 0.1W |
| 3239 | 4822 116 52249 | 1k8 5% 0.5W |
| 3240 | 4822 117 10834 | 47k 1% 0.1W |
| 3242▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3248 | 4822 051 20105 | 1M 5% 0.1W |
| 3249 | 4822 051 20105 | 1M 5% 0.1W |
| 3250 | 4822 117 11846 | 10k 5% 1/16W |
| 3251 | 4822 050 11003 | 10k 1% 0.4W |
| 3252▲ | 4822 051 20109 | 10Ω 5% 0.1W |
| 3253▲ | 4822 051 20109 | 10Ω 5% 0.1W |
| 3254 | 4822 051 20561 | 560Ω 5% 0.1W |
| 3255 | 4822 050 11002 | 1k 1% 0.4W |
| 3256▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3257▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3259▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3261 | 4822 051 20223 | 22k 5% 0.1W |
| 3262 | 4822 116 52283 | 4k7 5% 0.5W |
| 3263 | 4822 050 11503 | 15k 1% 0.4W |
| 3264 | 4822 101 11191 | 10k 30% 0.1W |
| 3270▲ | 4822 051 20153 | 15k 5% 0.1W |
| 3271 | 4822 116 52283 | 4k7 5% 0.5W |
| 3273 | 4822 051 20104 | 100k 5% 0.1W |
| 3275 | 4822 051 20822 | 8k2 5% 0.1W |
| 3276 | 4822 051 20822 | 8k2 5% 0.1W |
| 3280▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3303 | 4822 116 52219 | 330Ω 5% 0.5W |
| 3304 | 4822 050 11009 | 10Ω 5% 0.5W |
| 3310 | 4822 117 11684 | 4k7 LIN POTM |
| 3314 | 4822 117 12156 | 15k 5% 3W |
| 3315 | 4822 117 11896 | 1k5 20% 0.5W |
| 3323 | 4822 116 52221 | 360Ω 5% 0.1W |
| 3324▲ | 4822 051 20109 | 10Ω 5% 0.1W |
| 3330 | 4822 117 11684 | 4k7 LIN POTM |
| 3334 | 4822 117 12156 | 15k 5% 3W |
| 3335 | 4822 117 11896 | 1k5 20% 0.5W |
| 3344 | 4822 050 11009 | 10Ω 5% 0.5W |
| 3350 | 4822 117 11684 | 4k7 LIN POTM |
| 3354 | 4822 117 12156 | 15k 5% 3W |
| 3355 | 4822 117 11896 | 1k5 20% 0.5W |
| 3370▲ | 4822 052 11109 | 10Ω 5% 0.5W |
| 3371▲ | 4822 052 10108 | 1Ω 5% 0.33W |
| 3372▲ | 4822 052 10108 | 1Ω 5% 0.33W |
| 3374 | 4822 117 11896 | 1k5 20% 0.5W |
| 3400 | 4822 116 52283 | 4k7 5% 0.5W |
| 3401 | 4822 050 12202 | 2k2 1% 0.4W |
| 3402 | 4822 050 12202 | 2k2 1% 0.4W |
| 3403 | 4822 117 11681 | 820Ω 5% |
| 3403 | 4822 117 12646 | 390Ω 5% 2W |
| 3404 | 4822 050 11002 | 1k 1% 0.4W |
| 3404 | 4822 050 11502 | 1k5 1% 0.4W |
| 3405 | 4822 050 11509 | 15Ω 5% 0.4W |
| 3405 | 4822 050 14709 | 47Ω 1% 0.4W |
| 3405 | 4822 116 52193 | 39Ω 5% 0.5W |
| 3406 | 4822 050 12002 | 2k 1% 0.4W |
| 3406 | 4822 050 12202 | 2k2 1% 0.4W |
| 3407▲ | 4822 050 12201 | 220Ω 1% 0.4W |
| 3407 | 4822 050 13901 | 390Ω 1% 0.4W |
| 3410 | 4822 100 11391 | 330Ω 30% 0.1W |
| 3411 | 4822 050 12703 | 27k 1% 0.4W |
| 3411 | 4822 050 13303 | 33k 1% 0.4W |
| 3412 | 4822 050 12203 | 22k 1% 0.4W |
| 3414 | 4822 111 31051 | 3Ω3 5% |
| 3414 | 4822 116 81755 | 2Ω2 0.25W |
| 3418 | 4822 111 31051 | 3Ω3 5% |
| 3418 | 4822 116 81755 | 2Ω2 0.25W |
| 3420 | 4822 101 11191 | 10k 30% 0.1W |
| 3421 | 4822 051 20824 | 820k 5% 0.1W |
| 3422▲ | 4822 051 20153 | 15k 5% 0.1W |
| 3424 | 4822 117 12648 | 100Ω 5% 2W |
| 3425 | 4822 053 20335 | 3M3 5% 0.25W |
| 3427 | 4822 051 20822 | 8k2 5% 0.1W |
| 3428 | 4822 117 11454 | 820Ω 1% 0.1W |
| 3440▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3441 | 4822 051 20683 | 68k 5% 0.1W |
| 3442 | 4822 050 12209 | 22Ω 1% 0.4W |
| 3443 | 4822 051 20561 | 560Ω 5% 0.1W |
| 3444 | 4822 117 12649 | 10k 5% 2W |
| 3445 | 4822 117 12624 | 10Ω 5% 2W |
| 3446▲ | 4822 116 83749 | 680Ω 1/4W |
| 3450▲ | 4822 052 10398 | 3Ω9 5% 0.33W |
| 3454 | 4822 052 10821 | FUSE RST 820Ω |
| 3454 | 4822 052 11152 | 1k5 5% 0.5W |
| 3456 | 4822 053 20224 | 220k 5% 0.25W |
| 3460 | 4822 050 12703 | 27k 1% 0.4W |
| 3460 | 4822 111 20433 | 20k 5% |
| 3461 | 4822 050 12703 | 27k 1% 0.4W |
| 3462 | 4822 050 22204 | 220k 1% 0.6W |

# 12. Spare parts list

| | | |
|---|---|---|
| 3470▲ | 4822 052 11478 | 4Ω7 5% 0.5W |
| 3471 | 4822 117 12651 | 22Ω 5% 2W |
| 3480 | 4822 117 12648 | 100Ω 5% 2W |
| 3499▲ | 4822 052 10108 | 1Ω 5% 0.33W |
| 3500▲ | 4822 117 12164 | 430V - 710V |
| 3501 | 4822 117 12181 | 470Ω 20% 0.5W |
| 3503 | 4822 116 40204 | 30Ω 30% |
| 3504▲ | 4822 116 40277 | PTC 9Ω S 100R |
| 3506 | 4822 116 82776 | 2Ω2 |
| 3507 | 4822 117 12654 | 100Ω 5% 5W |
| 3510 | 4822 117 12647 | 33k 5% 3W |
| 3512 | 4822 117 12652 | 1k5 5% 2W |
| 3513▲ | 4822 051 20008 | 0Ω JUMPER |
| 3517 | 4822 117 11846 | 10k 5% 1/16W |
| 3518▲ | 4822 116 83027 | R22 5% 3W |
| 3518 | 4822 117 10422 | 0.33Ω 5% 3W |
| 3520 | 4822 117 11149 | 82k 1% 0.1W |
| 3521 | 4822 116 52219 | 330Ω 5% 0.5W |
| 3525▲ | 4822 052 10229 | 22Ω 5% 0.33W |
| 3528 | 4822 116 83868 | 150Ω 5% 0.5W |
| 3529 | 4822 117 11778 | 4Ω7 5% |
| 3530 | 4822 050 13902 | 3k9 1% 0.4W |
| 3532▲ | 4822 051 20008 | 0Ω JUMPER |
| 3534 | 4822 051 20224 | 220k 5% 0.1W |
| 3536 | 4822 051 20393 | 39k 5% 0.1W |
| 3537 | 4822 117 11846 | 10k 5% 1/16W |
| 3538 | 4822 050 11004 | 100k 1% 0.4W |
| 3539 | 4822 116 52251 | 18k 5% 0.5W |
| 3540 | 4822 101 11189 | 4.7k 30% 0.1W |
| 3541 | 4822 117 12653 | 47Ω 5% 2W |
| 3542▲ | 4822 053 21475 | 4M7 5% 0.5W |
| 3545▲ | 4822 053 21225 | 2M2 5% 0.5W |
| 3546▲ | 4822 053 21475 | 4M7 5% 0.5W |
| 3565 | 4822 117 11846 | 10k 5% 1/16W |
| 3566 | 4822 051 20331 | 330Ω 5% 0.1W |
| 3567 | 4822 051 20681 | 680Ω 5% 0.1W |
| 3568 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3569▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3601 | 4822 116 90885 | 8k2 X 6 |
| 3602 | 4822 117 12168 | 2k2 X 6 |
| 3603 | 4822 116 90884 | 8k2 X 10 |
| 3610 | 4822 117 11846 | 10k 5% 1/16W |
| 3612 | 4822 051 20224 | 220k 5% 0.1W |
| 3613▲ | 4822 051 20008 | 0Ω JUMPER |
| 3614▲ | 4822 051 20109 | 10Ω 5% 0.1W |
| 3614▲ | 4822 051 20153 | 15k 5% 0.1W |
| 3615▲ | 4822 051 20109 | 10Ω 5% 0.1W |
| 3615 | 4822 117 11846 | 10k 5% 1/16W |
| 3616▲ | 4822 051 20109 | 10Ω 5% 0.1W |
| 3616 | 4822 051 20223 | 22k 5% 0.1W |
| 3617 | 4822 050 11203 | 12k 1% 0.4W |
| 3618 | 4822 050 11503 | 15k 1% 0.4W |
| 3620 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3621 | 4822 051 20561 | 560Ω 5% 0.1W |
| 3622 | 4822 051 20561 | 560Ω 5% 0.1W |
| 3623 | 4822 117 11846 | 10k 5% 1/16W |
| 3624 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3625 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3626 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3627 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3628 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3630 | 4822 051 20822 | 8k2 5% 0.1W |
| 3630 | 4822 117 11383 | 12k 1% 0.1W |
| 3631 | 4822 117 10834 | 47k 1% 0.1W |
| 3632 | 4822 051 20333 | 33k 5% 0.1W |
| 3633 | 4822 051 20333 | 33k 5% 0.1W |
| 3634 | 4822 117 10834 | 47k 1% 0.1W |
| 3635 | 4822 051 20154 | 150k 5% 0.1W |
| 3636 | 4822 117 10834 | 47k 1% 0.1W |
| 3638 | 4822 050 11202 | 1k2 1% 0.4W |
| 3638 | 4822 116 52249 | 1k8 5% 0.5W |
| 3639 | 4822 051 20562 | 5k6 5% 0.1W |
| 3640 | 4822 050 18202 | 8k2 1% 0.4W |
| 3641 | 4822 050 18202 | 8k2 1% 0.4W |
| 3642 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3650 | 4822 117 11449 | 2k2 1% 0.1W |
| 3653 | 4822 051 20105 | 1M 5% 0.1W |
| 3654 | 4822 051 20822 | 8k2 5% 0.1W |
| 3655 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3656 | 4822 117 11503 | 220Ω 1% 0.1W |
| 3657 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3658 | 4822 051 20681 | 680Ω 5% 0.1W |
| 3660 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3661 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3662 | 4822 050 11002 | 1k 1% 0.4W |
| 3663 | 4822 051 20681 | 680Ω 5% 0.1W |
| 3664 | 4822 051 20104 | 100k 5% 0.1W |
| 3666 | 4822 051 20273 | 27k 5% 0.1W |
| 3668 | 4822 051 20224 | 220k 5% 0.1W |
| 3669 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3670 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3674 | 4822 116 52283 | 4k7 5% 0.5W |
| 3676 | 4822 050 12703 | 27k 1% 0.4W |
| 3677 | 4822 050 18202 | 8k2 1% 0.4W |
| 3681 | 4822 117 11846 | 10k 5% 1/16W |
| 3682 | 4822 117 11846 | 10k 5% 1/16W |
| 3683 | 4822 050 11004 | 100k 1% 0.4W |
| 3684 | 4822 117 11846 | 10k 5% 1/16W |
| 3685 | 4822 116 83884 | 47k 5% 0.5W |
| 3686▲ | 4822 051 20153 | 15k 5% 0.1W |
| 3690 | 4822 051 20182 | 1k8 5% 0.1W |
| 3690 | 4822 117 11454 | 820Ω 1% 0.1W |
| 3694 | 4822 051 20562 | 5k6 5% 0.1W |
| 3695 | 4822 051 20562 | 5k6 5% 0.1W |
| 3696 | 4822 051 20562 | 5k6 5% 0.1W |
| 3697 | 4822 116 52213 | 180Ω 5% 0.5W |
| 3698▲ | 4822 051 20102 | 1k 5% 0.1W |
| 3996▲ | 4822 051 20153 | 15k 5% 0.1W |
| 3996 | 4822 117 11846 | 10k 5% 1/16W |
| 3997 | 4822 051 20154 | 150k 5% 0.1W |
| 3997 | 4822 051 20223 | 22k 5% 0.1W |
| 3997 | 4822 051 20562 | 5k6 5% 0.1W |
| 3997 | 4822 051 20683 | 68k 5% 0.1W |
| 3997 | 4822 117 10834 | 47k 1% 0.1W |

### Coils

| | | |
|---|---|---|
| 5014 | 4822 157 63065 | 0.68µH 10% |
| 5015 | 4822 152 20547 | 0.68µH 10% |
| 5100▲ | 4822 157 53941 | 100µH 10% |
| 5206 | 4822 157 53303 | 12µH 10% |
| 5206 | 4822 157 53634 | 5.6µH 10% |
| 5209 | 4822 157 52333 | 100µH 10% |
| 5260 | 4822 157 70704 | 38.9 MHz |
| 5260 | 4822 157 70942 | 45.75MHz |
| 5286 | 4822 157 53303 | 12µH 10% |
| 5287 | 4822 157 53303 | 12µH 10% |
| 5288 | 4822 157 53303 | 12µH 10% |
| 5442 | 4822 157 53139 | 4.7µH 10% |
| 5445▲ | 4822 140 10612 | L.O.T. |
| 5451 | 4822 158 10549 | 12µH 10% |
| 5457 | 4822 157 11167 | 47µH 5% |
| 5458 | 4822 157 11167 | 47µH 5% |
| 5500 | 4822 157 10999 | LINE FILT.30mH |
| 5500 | 4822 157 11163 | LINE 22mH |
| 5515 | 4822 157 60171 | EMI FILT.100MHz |
| 5516 | 4822 157 60171 | EMI FILT.100MHz |
| 5540 | 4822 157 52007 | 4U7 10% |
| 5545▲ | 4822 146 10716 | S.M.TRAFO |
| 5550 | 4822 157 60171 | EMI FILT.100MHz |
| 5551 | 4822 157 71157 | 27µH 5% |
| 5570 | 4822 157 60171 | EMI FILT.100MHz |
| 5571▲ | 4822 157 51462 | 10µH 10% |
| 5573 | 4822 157 60171 | EMI FILT.100MHz |
| 5601 | 4822 157 60123 | 6.8µH 10% |
| 5602 | 4822 157 60123 | 6.8µH 10% |
| 5620 | 4822 157 60123 | 6.8µH 10% |
| 5680 | 4822 157 52983 | 22µH 10% |
| 5683 | 4822 157 60123 | 6.8µH 10% |
| 5690 | 4822 157 60123 | 6.8µH 10% |

### Diodes

| | | |
|---|---|---|
| 6102▲ | 4822 130 30621 | 1N4148 |
| 6110▲ | 4822 130 30621 | 1N4148 |
| 6111▲ | 4822 130 30621 | 1N4148 |
| 6144 | 4822 130 34382 | BZX79-C8V2 |
| 6151 | 4822 130 34382 | BZX79-C8V2 |
| 6251▲ | 4822 130 30621 | 1N4148 |
| 6254 | 4822 130 34233 | BZX79-C5V1 |
| 6402▲ | 4822 130 30621 | 1N4148 |
| 6403 | 4822 130 42488 | BYD33D |
| 6424 | 4822 130 34382 | BZX79-C8V2 |
| 6440 | 4822 130 42488 | BYD33D |
| 6441 | 4822 130 42488 | BYD33D |
| 6443 | 4822 130 42488 | BYD33D |
| 6444 | 4822 130 34145 | BZX79-B39C |
| 6445▲ | 4822 130 32896 | BYD33M |
| 6449▲ | 4822 130 42489 | BYD33G |
| 6454 | 5322 130 31938 | BYV27-200 |
| 6461▲ | 4822 130 30621 | 1N4148 |
| 6464▲ | 4822 130 30621 | 1N4148 |
| 6470▲ | 4822 130 42489 | BYD33G |
| 6480 | 4822 130 34382 | BZX79-C8V2F |
| 6500 | 4822 130 34328 | BZX79-B30 |
| 6501 | 4822 130 34328 | BZX79-B30 |
| 6502 | 4822 130 31083 | GP15K-16 |
| 6502▲ | 4822 130 80858 | 1N5062 |
| 6503 | 4822 130 31083 | GP15K-16 |
| 6503▲ | 4822 130 80858 | 1N5062 |
| 6504 | 4822 130 31083 | GP15K-16 |
| 6504▲ | 4822 130 80858 | 1N5062 |
| 6505 | 4822 130 31083 | GP15K-16 |
| 6505▲ | 4822 130 80858 | 1N5062 |
| 6507 | 4822 130 42606 | BYD33J |
| 6508 | 4822 130 42606 | BYD33J |
| 6524▲ | 4822 130 31631 | BYV10-20 |
| 6537 | 4822 130 30842 | BAV21 |
| 6540 | 4822 130 30842 | BAV21 |
| 6550 | 4822 130 10807 | BYM36C |
| 6560 | 5322 130 31938 | BYV27-200 |
| 6563 | 4822 130 34233 | BZX79-C5V1 |
| 6570 | 5322 130 31938 | BYV27-200 |
| 6600▲ | 4822 130 34173 | BZX79-C5V6 |
| 6610 | 4822 130 34142 | BZX79-B33 |
| 6610 | 4822 130 82037 | HZT33 |
| 6650 | 4822 130 30862 | BZX79-C9V1 |
| 6653 | 4822 130 34233 | BZX79-C5V1 |
| 6663▲ | 4822 130 82029 | LTL307P |

### Transistors

| | | |
|---|---|---|
| 7001 | 5322 130 41983 | BC858B |
| 7002 | 5322 130 41983 | BC858B |
| 7003 | 5322 130 41983 | BC858B |
| 7004 | 5322 130 41983 | BC858B |
| 7102▲ | 5322 130 41982 | BC848B |
| 7109▲ | 5322 130 41982 | BC848B |
| 7110▲ | 5322 130 41982 | BC848B |
| 7116▲ | 5322 130 41982 | BC848B |
| 7120 | 4822 209 90462 | TDA7056B |
| 7124▲ | 5322 130 41982 | BC848B |
| 7150▲ | 5322 130 41982 | BC848B |
| 7183▲ | 5322 130 41982 | BC848B |
| 7214 | 5322 130 41983 | BC858B |
| 7215▲ | 5322 130 41982 | BC848B |
| 7216▲ | 5322 130 41982 | BC848B |
| 7217▲ | 5322 130 41982 | BC848B |
| 7225 | 4822 209 15105 | TDA8363 |
| 7225 | 4822 209 15106 | TDA8361E |
| 7225 | 4822 209 15251 | TDA8362E |
| 7225 | 4822 209 15285 | TDA8360E |
| 7240▲ | 5322 130 41982 | BC848B |
| 7245 | 4822 209 90129 | TDA8395P |
| 7255 | 4822 209 12635 | TDA4665 |
| 7269▲ | 5322 130 41982 | BC848B |
| 7310 | 4822 130 41782 | BF422 |
| 7330 | 4822 130 41782 | BF422 |
| 7350 | 4822 130 41782 | BF422 |
| 7401 | 4822 209 60955 | TDA3653B |
| 7440 | 4822 130 60511 | BC847B |
| 7441 | 5322 130 44647 | BC368 |
| 7445 | 4822 130 10206 | BUT11AX |
| 7480 | 4822 130 40855 | BC337 |
| 7518 | 4822 130 10806 | STP6NA60FI |
| 7518 | 4822 130 63787 | STP4NA60FI |
| 7520▲ | 4822 209 90025 | MC44603P |
| 7565 | 4822 130 40937 | BC548B |
| 7566 | 5322 130 41983 | BC858B |
| 7600 | 4822 209 14646 | SAA5290ZP |
| 7608▲ | 5322 130 41982 | BC848B |
| 7610▲ | 4822 209 73852 | PMBT2369 |
| 7620 | 4822 209 90962 | ST24W04B1 |
| 7650▲ | 5322 130 41982 | BC848B |
| 7667▲ | 5322 130 41982 | BC848B |
| 7677 | 4822 130 42705 | BC847 |
| 7681▲ | 5322 130 41982 | BC848B |
| 7682▲ | 5322 130 41982 | BC848B |

## Picture tube panel [B1]

### Various

| | | |
|---|---|---|
| ▲ | 4822 255 10355 | CRT SOCKET |
| ▲ | 4822 255 70293 | CRT SOCKET 14" |
| 1010 | 4822 212 11132 | CRT PANEL 14" |
| 1010 | 4822 212 11133 | CRT PANEL 20" |

### Capacitors

| | | |
|---|---|---|
| 2304 | 4822 126 13481 | 680pF 10% 50V |
| 2344 | 4822 126 13481 | 680pF 10% 50V |

### Resistors

| | | |
|---|---|---|
| 3300 | 4822 117 11683 | 2k2 LIN POTM |
| 3303 | 4822 116 52219 | 330Ω 5% 0.5W |
| 3303 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3304 | 4822 051 20129 | 12Ω 5% 0.1W |
| 3304 | 4822 051 20189 | 18Ω 5% 0.1W |
| 3311 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3311 | 4822 050 18201 | 820Ω 1% 0.4W |
| 3312 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3313 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3321▲ | 4822 116 83749 | 680Ω 1/4W |
| 3322 | 4822 050 11502 | 1k5 1% 0.4W |
| 3323 | 4822 116 52219 | 330Ω 5% 0.5W |
| 3323 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3324 | 4822 051 20569 | 56Ω 5% 0.1W |
| 3324 | 4822 051 20339 | 33Ω 5% 0.1W |
| 3331 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3331 | 4822 050 18201 | 820Ω 1% 0.4W |
| 3332 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3333 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3340 | 4822 117 11683 | 2k2 LIN POTM |
| 3343 | 4822 116 52219 | 330Ω 5% 0.5W |
| 3343 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3344▲ | 4822 051 20109 | 10Ω 5% 0.1W |
| 3344 | 4822 051 10159 | 15Ω 2% 0.25W |
| 3351 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3351 | 4822 050 18201 | 820Ω 1% 0.4W |
| 3352 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3353 | 4822 050 11001 | 100Ω 1% 0.4W |
| 3357 | 4822 117 11449 | 2k2 1% 0.1W |
| 3357 | 4822 051 20122 | 1k2 5% 0.1W |
| 3360 | 4822 051 20561 | 560Ω 5% 0.1W |
| 3361 | 4822 050 13302 | 3k3 1% 0.4W |
| 3362 | 4822 051 20681 | 680Ω 5% 0.1W |

### Coils

| | | |
|---|---|---|
| 5370 | 4822 157 51157 | 3.3µH 10% |
| 5370 | 4822 157 50961 | 22µH 10% |

### Diodes

| | | |
|---|---|---|
| 6310 | 4822 130 34171 | BZX79-C4V7 |
| 6314 | 4822 130 30841 | BAV21 |
| 6330 | 4822 130 34171 | BZX79-C4V7 |
| 6334 | 4822 130 30841 | BAV21 |
| 6350 | 4822 130 34171 | BZX79-C4V7 |
| 6354 | 4822 130 30841 | BAV21 |

### Transistors

| | | |
|---|---|---|
| 7300 | 4822 130 40931 | BC548 |
| 7320 | 4822 130 40931 | BC548 |
| 7340 | 4822 130 40931 | BC548 |
| 7360 | 4822 130 40941 | BC558 |